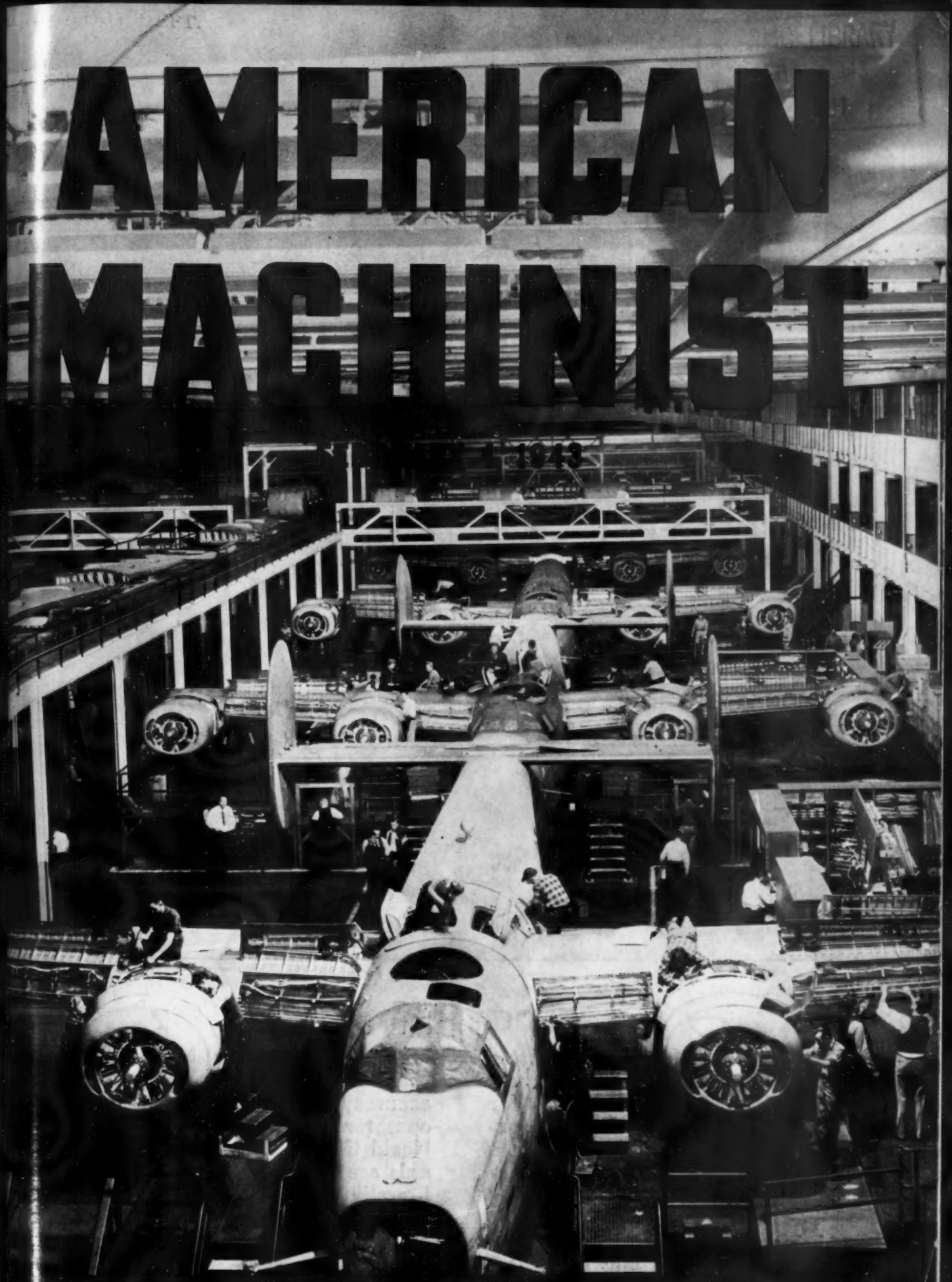
AMERICAN MACHINIST

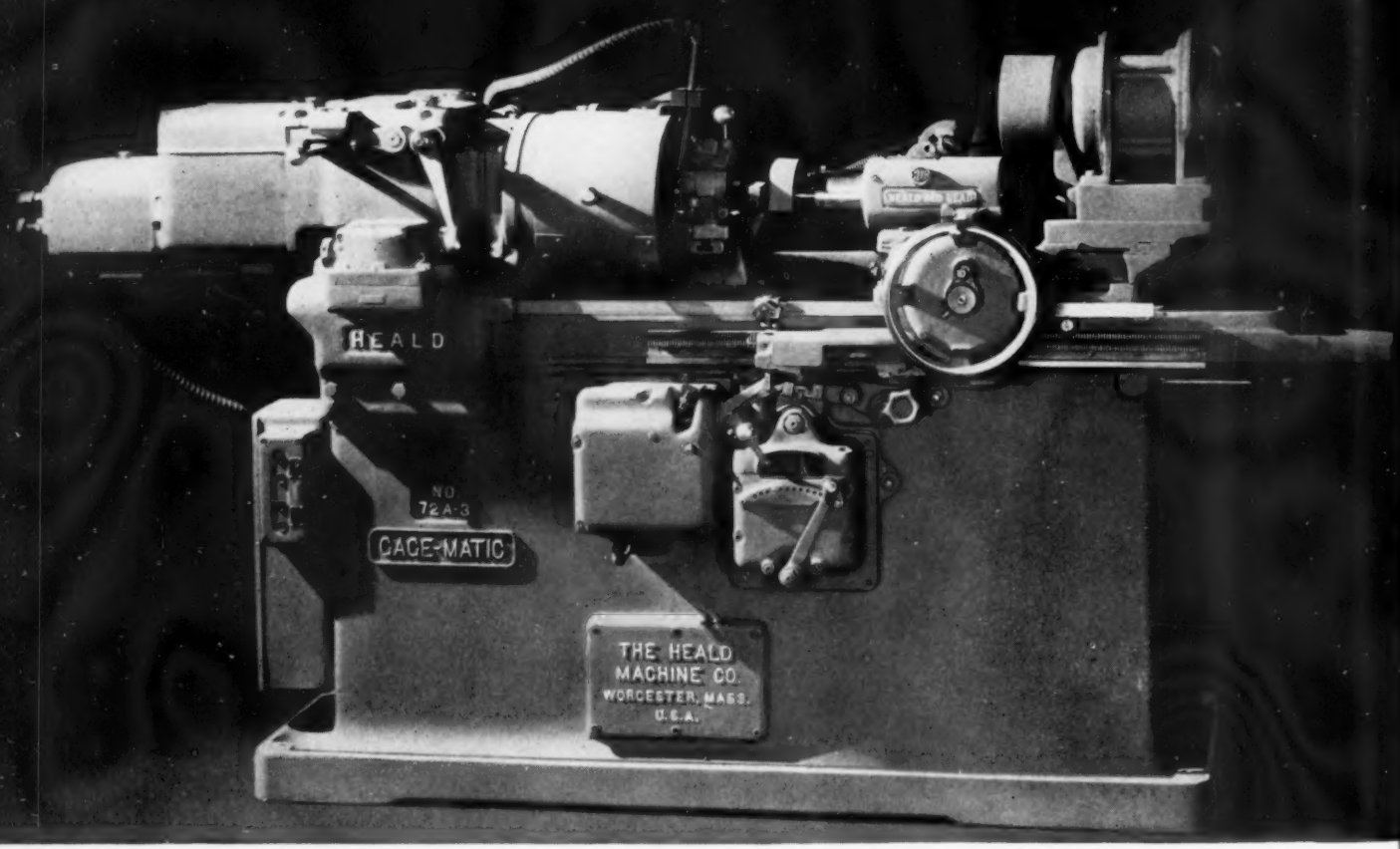
1943



ARMAMENT: Ford Production of Big Bombers—Page 93

ON THE NOSE EVERY TIME

EVEN WITH AVERAGE OPERATORS



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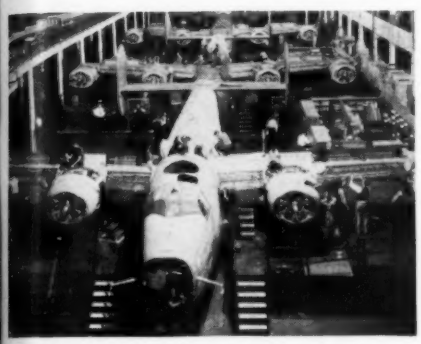
AMERICAN MACHINIST

February 4, 1943



Bomber Line—Automotive and aircraft technique are combined by Ford in manufacturing the Liberator bomber.

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ANNOUNCING

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Change in Page Size

● The overall page size of *American Machinist* has been reduced from 8¾ x 11⅝ to 8⅛ x 11¼.

This is in order to comply with War Production Board Order No. L-244, reducing by 10% the amount of paper that publishers may use this year as compared with 1942.

By this reduction in page size, we are able to continue all essential services, as before.

The amount of editorial matter, and the number of pages devoted to it, remain the same.

The size of type remains the same.

To compensate in part for smaller page margins, *American Machinist* is bound so as to open flat.

The new style of binding makes the book easier to handle and increases the visibility of the pages.

AMERICAN MACHINIST

SPEED AND PRECISION

OFFICIAL U. S. NAVY PHOTOGRAPH

START HERE

GRINDING A SPIRAL BEVEL AIRCRAFT PINION ON A NO. 17 HYPOID GRINDER

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GLEASON WORKS

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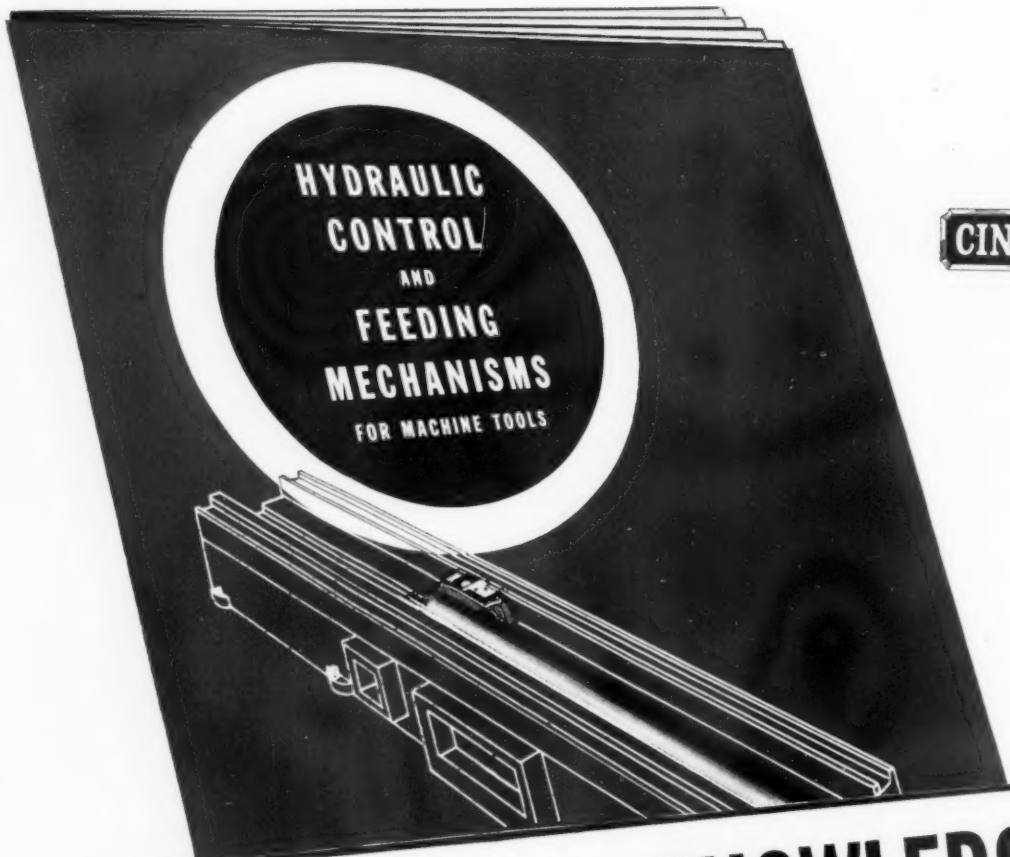
ARMY E NAVY



CINCINNATI

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THE CINCINNATI MILLING MACHINE CO.
CINCINNATI GRINDERS INCORPORATED
CINCINNATI, OHIO, U. S. A.

ARMY E NAVY

Navy E awarded March 6, 1942. Renewal Star awarded September 6, 1942, along with Army-Navy E.

THE CINCINNATI MI

MILLING MACHINE

become equal, thus shifting the valve to the left. This shift of the valve is used to open and close connections between the forward pressure and the main cylinder *D*, maintaining pressure on the cylinder during the feed of the "in and out" cylinders.

At *E* is shown a balancing valve which insures equality of pressure drop across the two resistances R_1 and R_2. This results in equal flows through the two legs at all times, and fulfills the requirement of equal feed rates on the two "in and out" cylinders.

When these cylinders reach the positive stop at *d*, *Fig.* 5, a short dwell is required to clear the cutters. Delayed trip valve at *F*, *Fig.* 6, is used for this purpose. As soon as the slides strike a positive stop, the back pressure immediately falls to zero. Since this pressure was holding the delayed trip valve in its upper position during the cycle, the valve will begin to drop by reason of a spring urge at the top. The movement of the valve is sluggish, however, because the oil must be displaced through resistance *R*. When the valve has completed its movement the ratchet at *G* is shifted, which causes the cycle to resume.

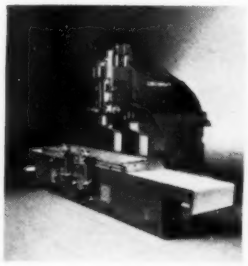


Fig. 7—Sensitive control of ponderous masses such as slides on this Hydro-Tel milling machine is one of the more recent applications of hydraulics

This circuit is cited as an example of the complexity which may arise when complex results are desired. Sequential and simultaneous functions as well as delays can be obtained by the use of flow and pressure-controlled valves.

At one time, hydraulic power was considered an agency of brute force as typified by the tremendous rams of hydraulic presses, the working pressures of which are measured in tons. A more recent application is that of the sensitive control of ponderous masses such as the sliding units of the machine shown

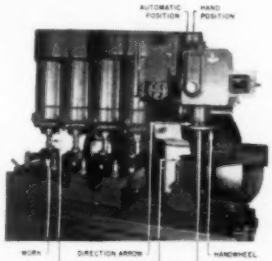


Fig. 8—Hydro-Tel milling machine equipped with 360° automatic profiling attachment

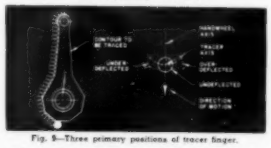


Fig. 9—Three primary positions of tracer finger.

in *Fig.* 7. This machine with standard equipment as illustrated, is used for general purpose milling on large, heavy work. When equipped with tracer attachment, as shown in *Fig.* 8, it is used for duplicate and multiple milling of contours on parts such as airplane motor connecting rods. Although the massive design of the slides and frame permits the use of large cutters and the taking of heavy cuts on roughing operations, light accurate cuts are easily attained. The use of a sensitive hydraulic control makes this wide range of operations possible.

The handwheel element, indicated in the illustration, *Fig.* 8, has a finger, or tracer, attached to it. Connected to this tracer are valves which control the direction of rotation of an hydraulic motor. The latter is geared to the handwheel which in turn controls directional valves for the two components of movement, namely, the table and the ram movements. An arrow on the handwheel shows the direction of resultant movement between the cutter and the work.

As shown in *Fig.* 9, the tracer finger is mounted eccentrically with respect to the axis of the handwheel, and it can be displaced from its own axis. Three primary positions determine the direction of rotation of the tracer axis about the handwheel axis, under-deflected, undeflected, and over-deflected. In

the under-deflected position, the tracer will rotate clockwise, in the over-deflected position, it will rotate counter-clockwise; while in the undeflected position, no rotation will take place. The movement from one primary position to the next represents very small displacements (approximately .001").

In operation, the knob above the tracer is set in the "hand" position and the arrow on the handwheel is pointed toward the template. As the tracer contacts the template, the mechanism shifts into the automatic position, and the tracing mechanism will immediately begin to seek equilibrium. If the tracer is over-deflected because of too much interference with the template, rotation away from template takes place to relieve this condition. This rotation changes the direction of the arrow on the handwheel, and, therefore, the resultant direction of motion. If, on the other hand, the tracer is under-deflected, the rotation will be toward the template. While the tracer is seeking the correct direction, the slides are being moved hydraulically. In the extreme positions of the tracer, the rate of motion is reduced to provide smooth action around corners.

As *Fig.* 8 indicates, the cutters and tracer are integrally mounted on one rigid member. Thus the cutter is compelled to describe the same relative path with respect to the workpiece as the tracer describes with respect to the template. The remaining requirement for duplication is that the cutter be the exact size and shape of the tracer. Force exerted between the tracer and the template is extremely small. It is possible to interpose one's finger between the tracer and template without the slightest danger of injury.

These examples of milling machines, their circuits and operations are taken from patents by the Cincinnati Milling Machine Co., and are merely illustrative of the flexibility which can be obtained by the use of hydraulics. Hydraulic-electric combinations also have been used with success for complex cyclic operations on milling machines and other machine tools.

The modern design engineer can no longer ignore the challenge of hydraulics. Its manifest advantages are now established facts where once they were questionable theories.

Milling the clutch shank of an impact tool on a CINCINNATI No. 2-24 Automatic Rise and Fall Milling Machine. The spindle carrier has hydraulically powered rapid traverse (up and down) and hydraulically powered feed (d... cycle — table traverse and spindl...

HYDRAULICS HELPS PRODUCTION

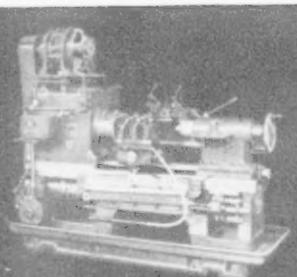
There is no substitute for knowing how, and if hydraulic troubles occur through neglect, such as the use of incorrect oil, it's certainly an advantage to know how to straighten out the difficulty quickly. This book will help you feel more sure of yourself when such troubles develop. And while we do not claim the information therein is a panacea for all hydraulic ills, we do know that if the simple, easy-to-follow routine as explained, is conscientiously practiced, you'll have little difficulty in keeping your hydraulically powered milling machines in practically continuous operation. "Hydraulic Control and Feeding Mechanism for Machine Tools" is based upon the wide experience of our Research and Field Engineers in the application of hydraulics to our products. It is another official communique from Milling Headquarters to help you get more continuous production from your CINCINNATI Milling Machines, and incidentally, your CINCINNATI Grinding Machines, too. A copy is yours for the asking. When writing, please be sure to specify booklet M-1001.

MILLING MACHINE CO. CINCINNATI, OHIO, U. S. A.

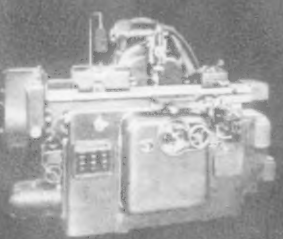
BROACHING MACHINES • GRINDING MACHINES • LAPPING MACHINES

Comparison Inspection of Production Parts

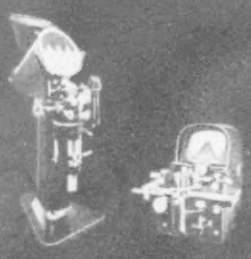
Courtesy International Business Machines



FAY AUTOMATIC LATHES



AUTOMATIC THREAD GRINDERS



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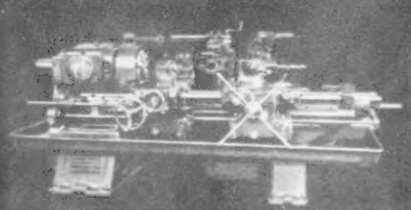

SADDLE TYPE
UNIVERSAL TURRET LATHES

PROFIT-PRODUCING
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RAM TYPE
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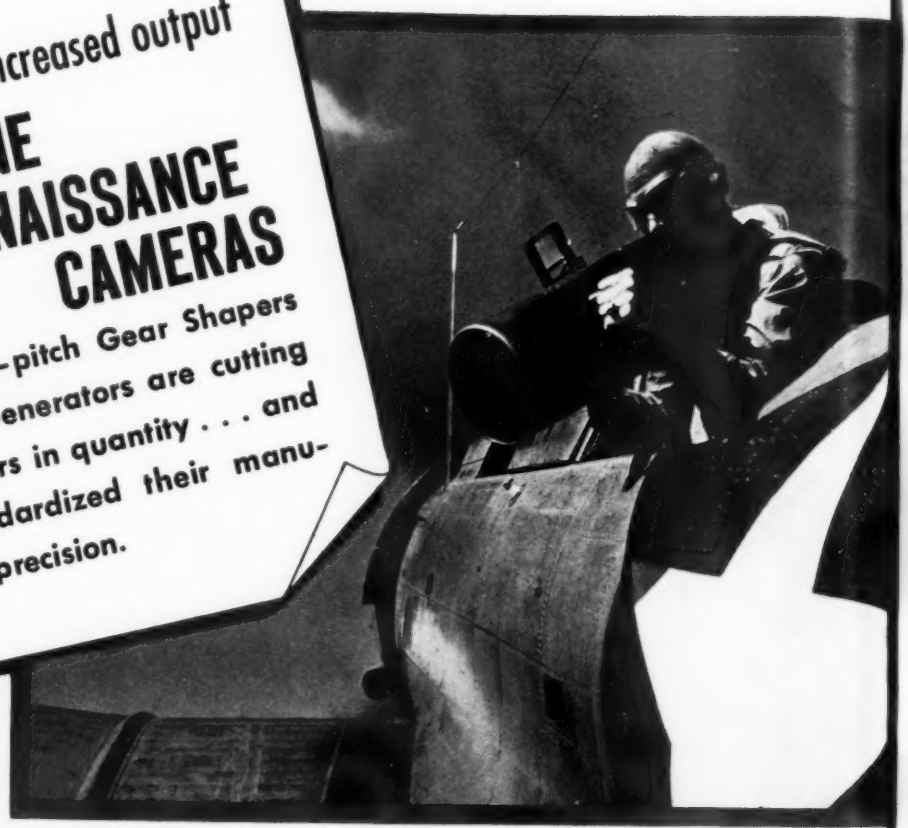
Fellows Fine-pitch Gear Shapers and Gear Generators are cutting shutter gears in quantity . . . and have standardized their manufacturing precision.



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THE STEAMY JUNGLE . . . .

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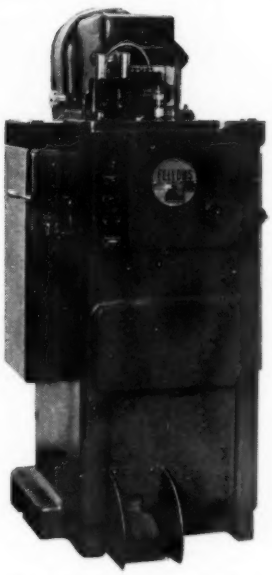

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Method

. . . . FROM BLANK TO FINISHED GEAR

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ENGINEERING

THAT COUNTS IN THE FINISH

CINCINNATI Hydraulic Universal Grinding Machines are made in 12", 14", 16" and 18" swings; between center distances up to 72".

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CINCINNATI GR

CINCIN

CENTER TYPE GRINDING MACHINES ENTERL

If you have a grinding problem, put it up to CINCINNATI Field and Factory Engineers.

In the illustration above, the mirror-like reflections on the cylinder ground on a CINCINNATI Grinding Machine with FILMATIC Spindle Bearings, are evidence of the exceedingly high finish it is possible to secure with these bearings. Finishes like this can also be obtained on CINCINNATI Hydraulic Universals.

FILMATIC Bearings, outstanding as they are, are only one of many important contributions that CINCINNATI Engineers here at Grinding Headquarters have made to precision cylindrical grinding. Others are: Infinitely Variable Work Speeds; Accuracy of Table Reversal Within .004"; Dog-Controlled Table Reciprocation from 3/32" to Full Table Stroke; Independent Right- and Left-Hand Tarry Adjustments; Two-Speed Hand Cross Traverse. You'll be interested in reading about the unusual features of CINCINNATI Hydraulic Universal Grinding Machines and their importance in improving your grinding performance.

Catalogs G-486 and G-474 explain these features and tell why they are beneficial to you. Both books are official communiques from Grinding headquarters and are yours for the asking. Send for your copies today.

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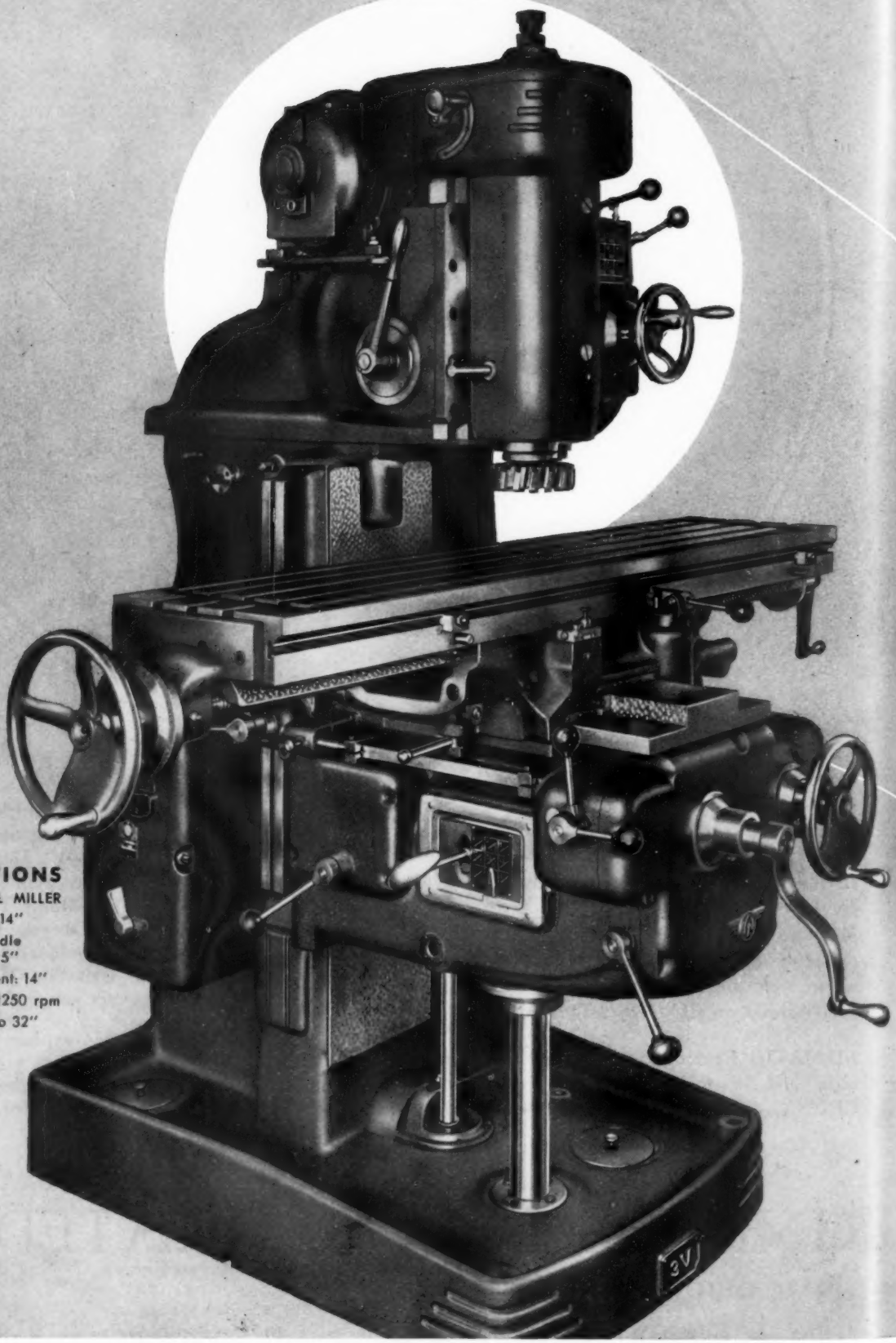
Adjustable Ram and



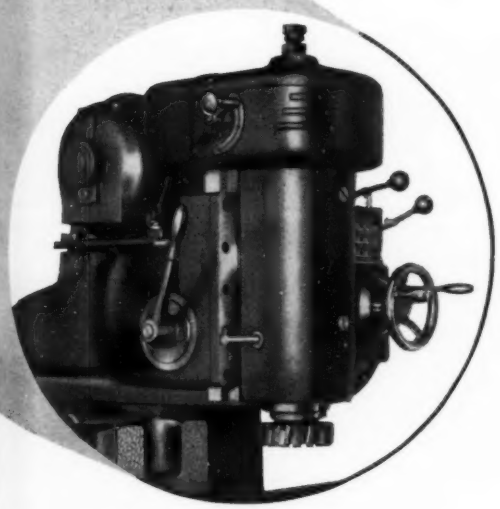
SPECIFICATIONS

No. 3 V VERTICAL MILLER
Table: 64" x 14"
Vertical Spindle Adjustment: 5"
Throat Adjustment: 14"
18 Speeds: 25 to 1250 rpm
18 Feeds: 3/8" to 32"

Spindle Assembly Increases Your Work Range

ON VAN NORMAN 3V VERTICAL MILLERS

Noteworthy of the many important features incorporated in the Van Norman 3V Miller is the adjustable vertical spindle, mounted on a sliding ram. This sliding ram permits the throat distance to be varied so that the spindle can be more closely coupled to the column . . . which means maximum rigidity that insures greater accuracy. The variable throat distance also increases the range of set-ups and work that can be handled on this machine.



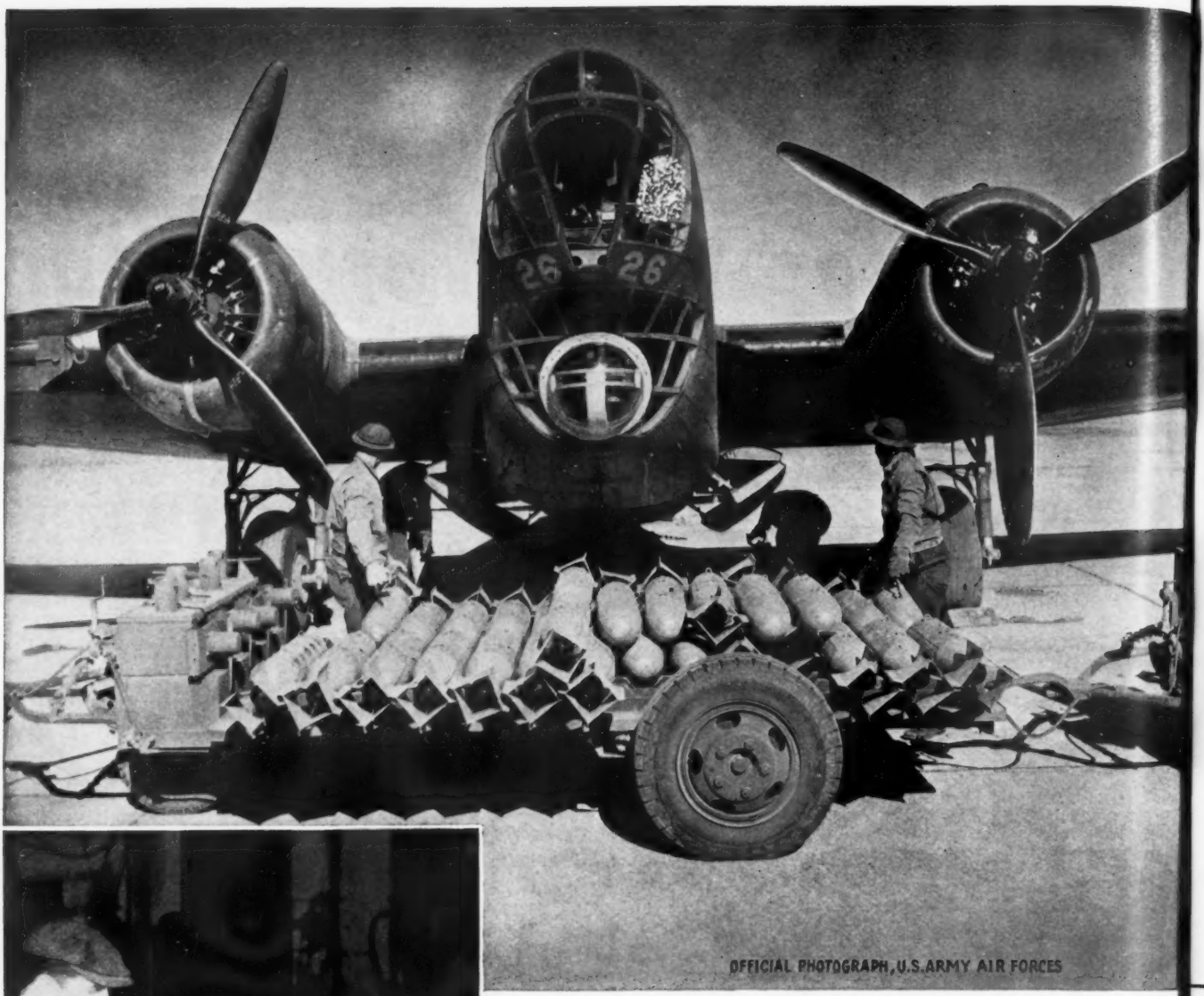
Easy to Reach, Quick-Acting Controls Speed Output

Conveniently located quick change speed levers, mounted on the ram, provide 18 speeds from 25 to 1250 rpm. Vertical adjustment of the heavy spindle is quickly made with the large hand wheel. 4 position dial indicator stop for step milling can be mounted on the front of the ram unit. Heavy sliding ram is easily positioned by means of crank on left side of column, and is solidly locked by cam-type gib clamps. In addition, the front and rear directional controls of power feeds, rapid traverse for table, knee and saddle provide ease of operation and help to increase output.

Van Norman Milling Machines

ARMY E NAVY

VAN NORMAN MACHINE TOOL CO., SPRINGFIELD, MASS.



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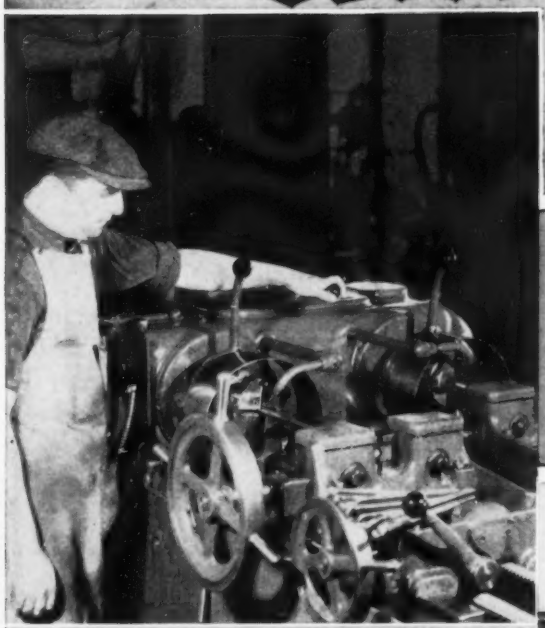

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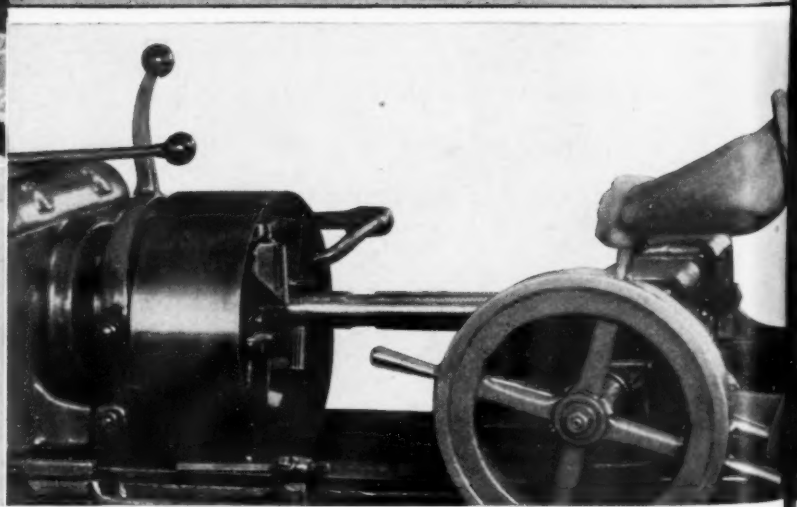

For high production and accurate threading of vital components used in the manufacture of war material, Landmaco Threading Machines and Landis Die Heads are setting new performance records.

(Threading Problems in War Production Solved by LANDIS Engineers)

Landis Threads Now Open Bomb Doors in a Jiffy ....

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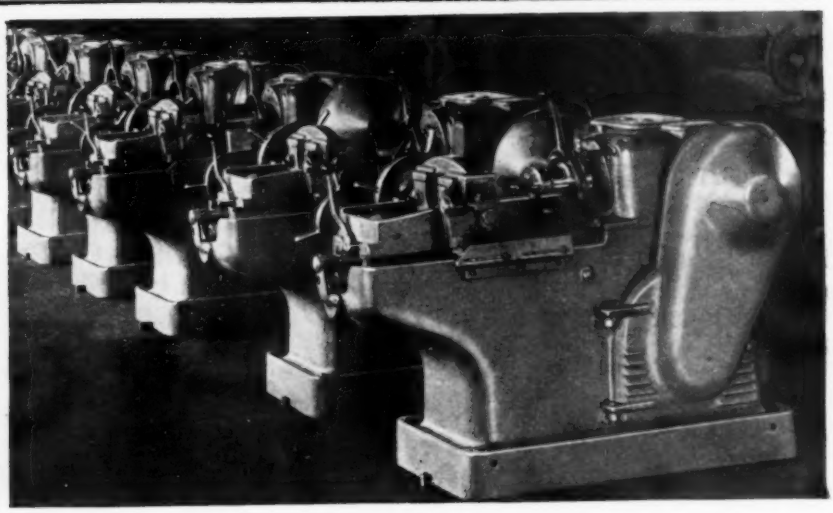
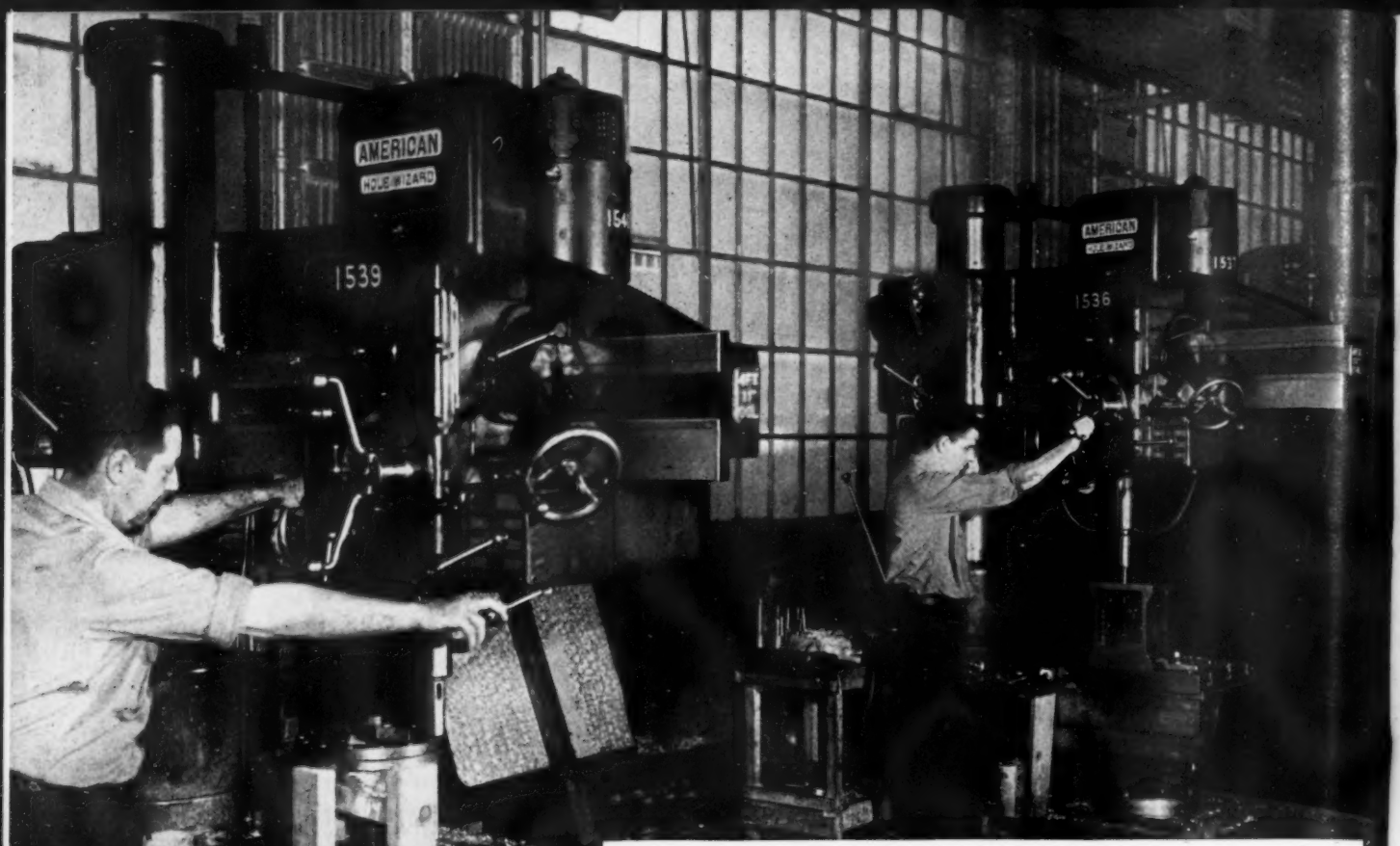
To guarantee smooth, precise operation of the bomb doors, one manufacturer of heavy bombers employs a Landmaco Threading Machine to cut the long acme double thread screws required to perform this vital operation. The threads must be held to close tolerance specifications and must have a smooth, unmarred surface.

The Landmaco Threading Machine, in the words of this manufacturer, has "more than met these specifications"!

Write for Bulletin No. H75
Descriptive of the Landmaco Threading Machine

MACHINE CO. WAYNESBORO PENNA. U.S.A.





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FOR
ALL-OUT
PRODUCTION

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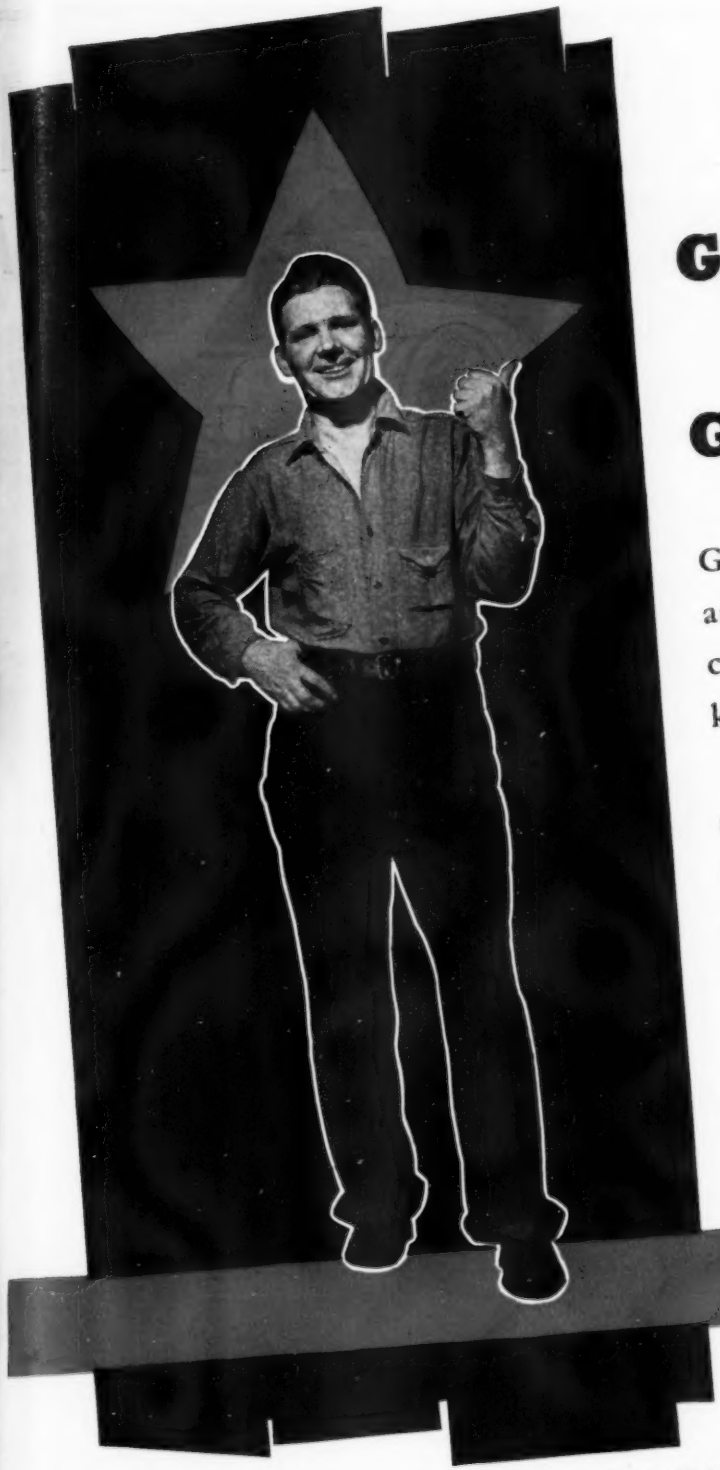
"AMERICAN" *Hole Wizard* RADIALS

LATHES **RADIALS** **SHAPERS**



Good Automatics DESERVE Good Operators

Good operators can get the most from any machine, and, because seconds count so much, automatics should be kept in use at peak efficiency.

The Departmental Design of Conomatics helps new operators to learn faster. The extra rigid cross-slide construction permits holding heavier forming cuts to closer tolerances.

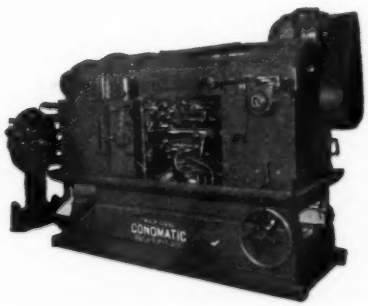
Cone handbooks are useful in helping both new and experienced operators to get excellent results from Cone machines.

PRIME YOUR PRODUCTION PULSE—SPECIFY CONES

ARMY E NAVY

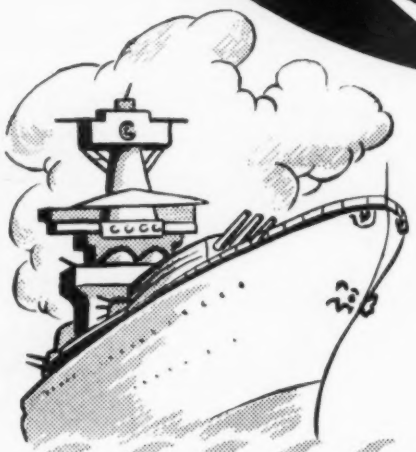
CONE AUTOMATIC MACHINE COMPANY, INC.

WINDSOR, VERMONT
U.S.A.

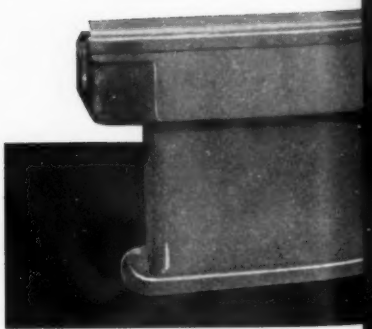


ATTENTION A.

Here Is A Mac



Above:--A Landis Type D Grinder at the plant of a very old and famous shipyard is shown grinding a boring bar.



PRECISION LANDIS GRINDERS

Unusual Performance As Usual

ALL SHIPBUILDERS

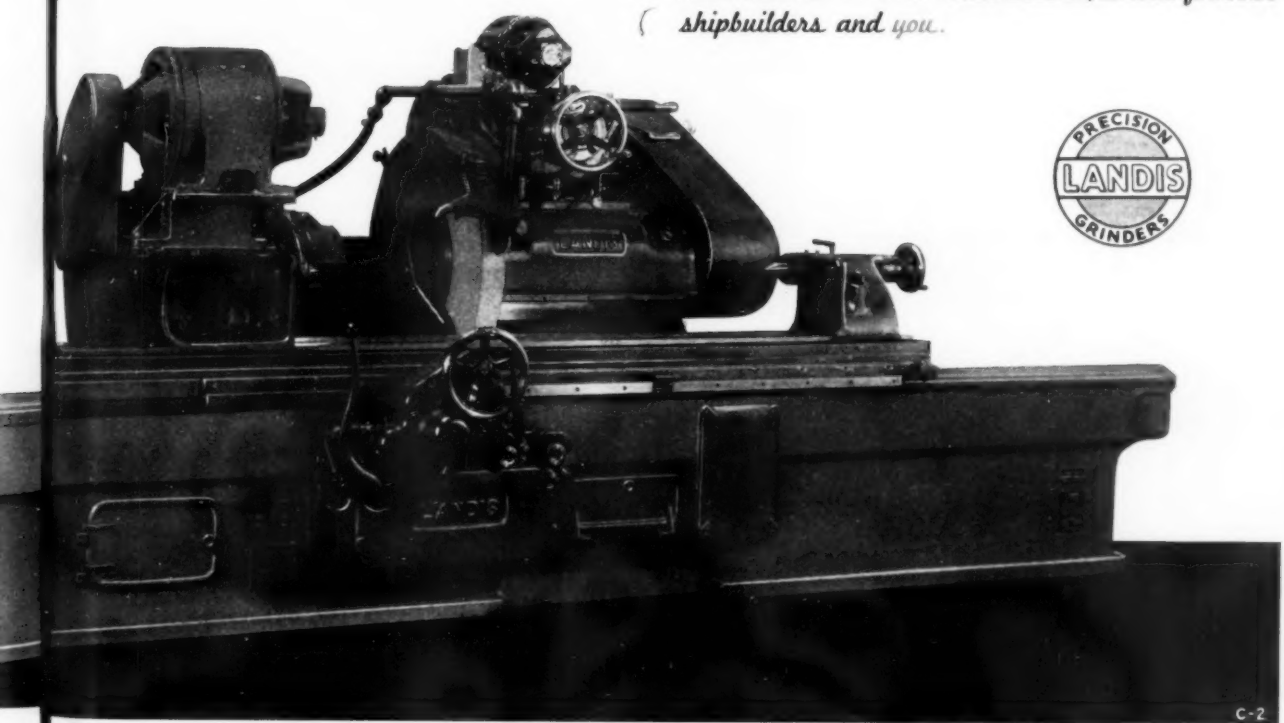
Machine To Meet Your Most Severe Demands

A large shipbuilding company is using a Landis 16" x 72" Type D Plain Hydraulic Grinder for two important purposes. One is for the production grinding of rollers 7" in diameter and 9" in length. The second purpose is for the grinding of large heavy odd jobs of a tool room nature such as the boring bar shown in the illustration at left.

Not only shipbuilders, but all other manufacturers should learn more about this rugged Type D Grinder. The machine was designed and built to handle relatively heavy work. It will remove unusually large amounts of stock and will meet the most stringent precision requirements satisfactorily. In addition the Type D is ideal for various wide wheel and multiple wheel grinding operations.

Some suggested parts which can be ground profitably on the Type D Plain are spindles, shafts, Diesel engine pistons, large motor armatures, crankshaft line bearings and small straight face rolls.

Any machine tool being employed by the shipbuilding industry is subject to hard and continuous usage. The Landis Type D Plain Grinder has been built to "take it." And take it, it will for both shipbuilders and you.



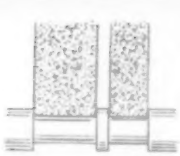
PRECISION LANDIS GRINDERS

C-2

LANDIS TOOL COMPANY WAYNESBORO PENNSYLVANIA

IDEAL FOR GRINDING STRAIGHT FACE ROLLS IN THE SMALLER SIZES

IDEAL FOR GRINDING CRANKSHAFT LINE BEARINGS



IDEAL FOR MULTIPLE WHEEL GRINDING

388

EVERY SUB COMMANDER KNOWS THE IMPORTANCE OF

Centralized Control

Instant response — unfailing action in every mechanical element of the ship — is vital to protect the lives of the crew as well as giving striking power to the submarine. From his station, the commander skillfully directs its performance through centralized control equipment.

★ ★ ★

The centralized controls of Milwaukee Milling Machines give the operator complete command of his machine — enable him to control its performance to the fine degree he demands for the full expression of his skill.

Speed and feed dials — all control levers within easy reach — the latter duplicated front and rear on plain and universal horizontal machines (model 2K and larger) — contribute to the sustained precision of Milwaukees, in the tool room or on the production line.

KEARNEY & TRECKER
CORPORATION
MILWAUKEE, WISCONSIN

Buy Victory with at least 10% in War Bonds!

Milwaukee MACHINE TOOLS

18 CAM MILLING METHODS

Let's Put The Scrap Into The *Scrap!*

Turnings, clippings, short ends, worn out or broken tools — all these are valuable as precious scrap for remelting in the production of new steel. Surprising amounts of dormant scrap accumulate in every plant daily — collect it — segregate it. Set up a system for the regular pick-up and handling of this valuable raw material. Remember, it's a war on waste, too, and every bit of scrap *collected* counts in production for Victory.

. . . Described and Explained in this Kearney & Trecker Corporation Bulletin

Machining and milling cams of various types present special problems. This series of articles, reprinted from American Machinist in bulletin form, explains methods of cam milling from the practical shopman's viewpoint.

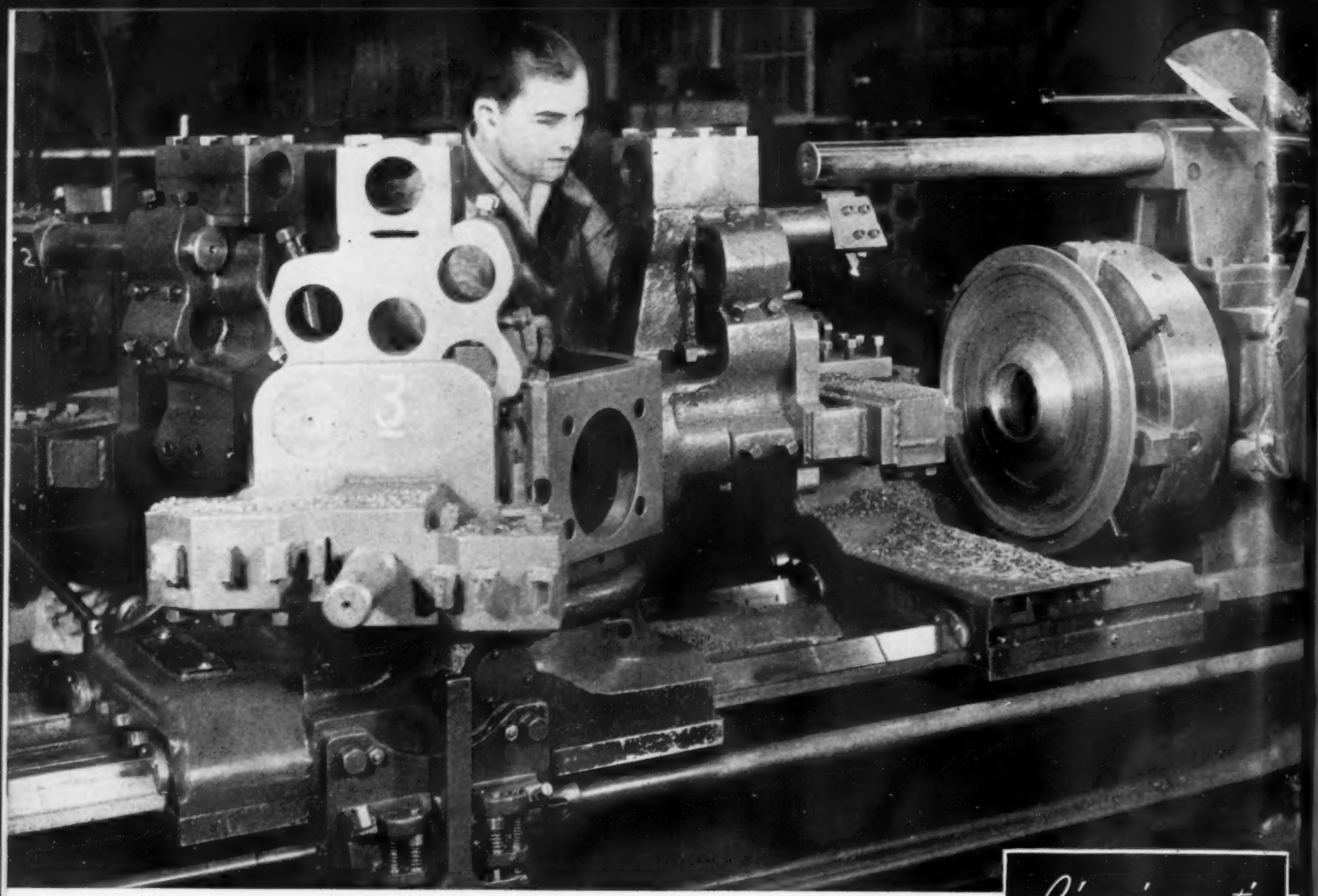
Many machine setups are illustrated, including working diagrams. Eighteen cam milling methods are described, such as use of the Rotary Table, Dividing Head, Dummy Templets, Rotary Head Milling Machine, etc.

Written by the department of Industrial Research, Kearney & Trecker Corporation, this bulletin will prove valuable to every shopman. Write Dept. CM for your copy.

Buy Victory with at least 10% in War Bonds!

Kearney & Trecker
Products
CORPORATION
MILWAUKEE, WISCONSIN
Subsidiary of Kearney & Trecker Corporation

Kearney & Trecker
CORPORATION
Milwaukee, Wisconsin



Cincinnati
ACME
UNIVERSAL
TURRET LATHES

RIGIDITY! CAPACITY! FOR MACHINING TANK TRANSMISSION PARTS

AND MANY OTHER JOBS IN WAR PRODUCTION

War production jobs such as this one (illustrated above and described at the right) call for a Turret Lathe with rigidity and capacity to machine large diameter parts with utmost accuracy and efficiency.

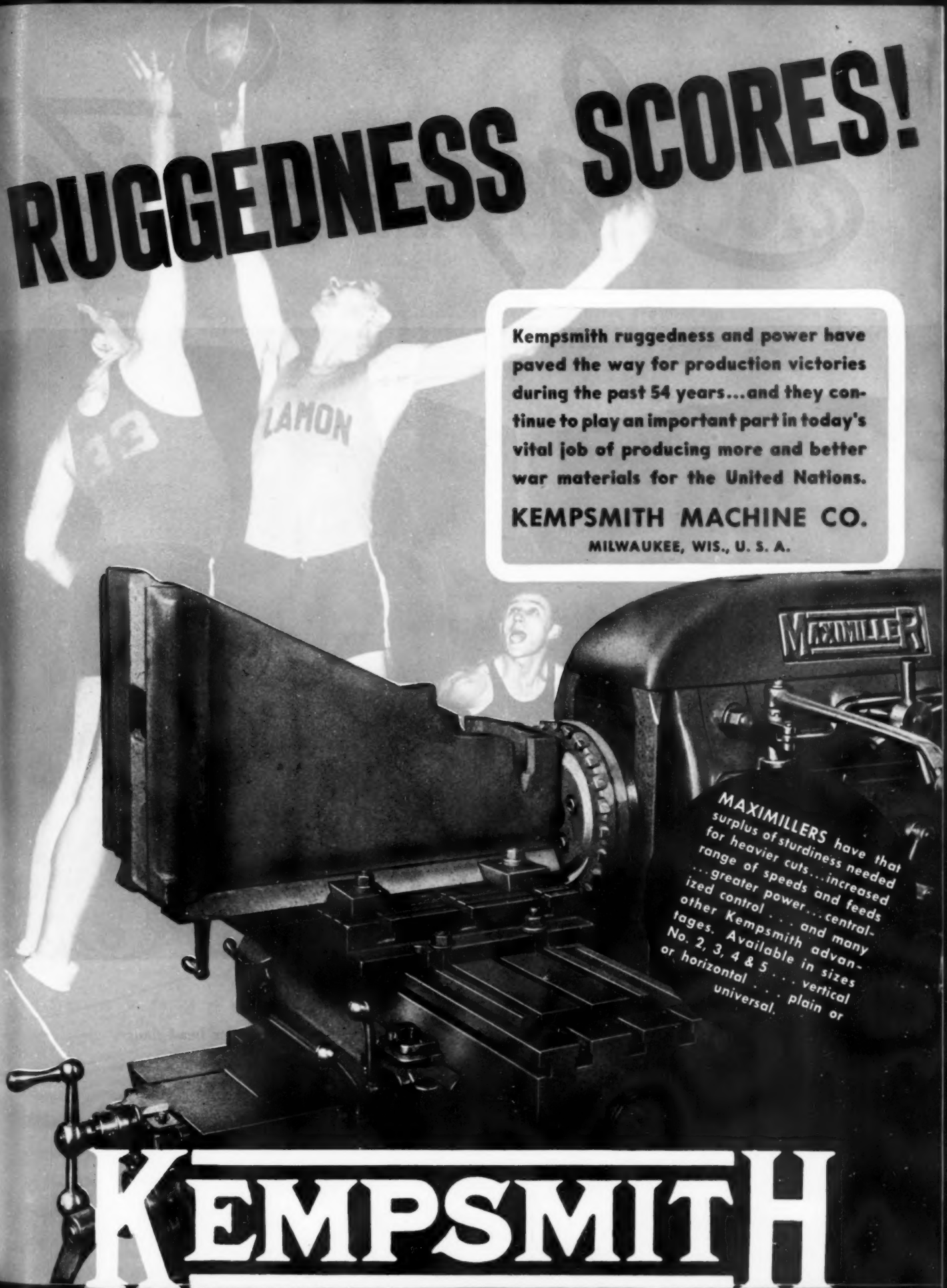
RIGIDITY! In the 3S Universal Turret Lathe, the triple-gibbed square turret carriage, the extra heavy spindle mounted on three sets of precision roller bearings, the heavy, accurately machined main turret and saddle are all designed to offer maximum resistance to the deflection of heavy, high-speed cutting.

CAPACITY! Maximum tooling and work-holding capacity are incorporated in Cincinnati-Acme design. And Acme rigidity enables the user to take full advantage of every inch of swing and longitudinal travel. Write for bulletins, specifications and engineering suggestions covering any phase of Turret Lathe production.

The No. 3S CINCINNATI-ACME Universal Fixed Center Turret Lathe, shown above, is machining tank transmissions parts approximately 18" in diameter. Three special piloted cutter blocks are used for turning, forming and sweep facing these hydraulic case covers. Even on large jobs like this, operation is free from chatter, the finish smooth and the part machined to close limits.

The ACME MACHINE TOOL CO.,
CINCINNATI OHIO

RUGGEDNESS SCORES!



Kempsmith ruggedness and power have paved the way for production victories during the past 54 years...and they continue to play an important part in today's vital job of producing more and better war materials for the United Nations.

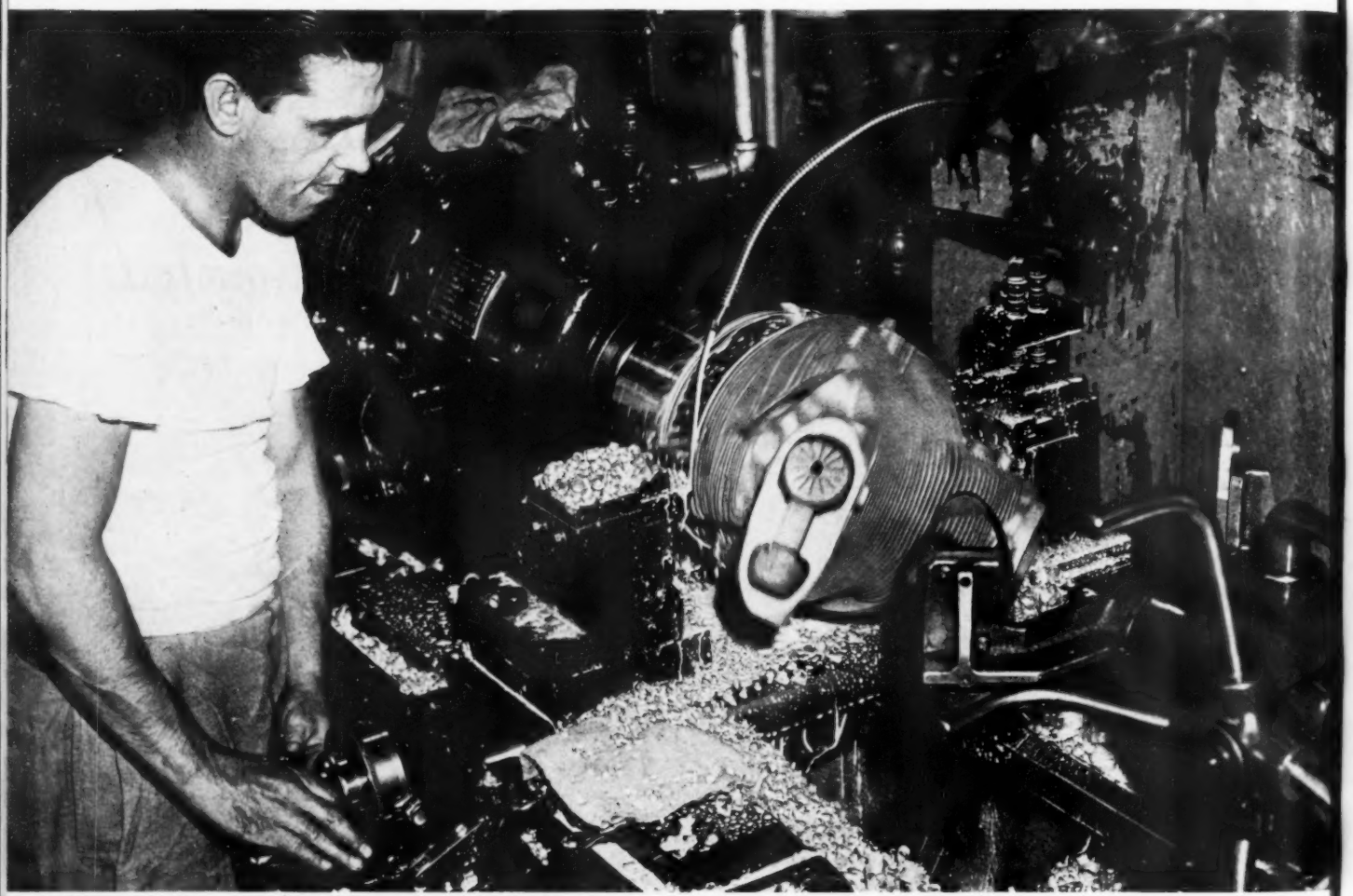
KEMPSMITH MACHINE CO.
MILWAUKEE, WIS., U. S. A.

MAXIMILLERS have that surplus of sturdiness needed for heavier cuts...increased range of speeds and feeds ...greater power...centralized control . . . and many other Kempsmith advantages. Available in sizes No. 2, 3, 4 & 5 . . . vertical or horizontal . . . plain or universal.

KEMPSMITH

• Precision Built Milling Machines Since 1888 •

Ingenuity



Photographs by courtesy of Wright Aeronautical Corporation.

This operation consists of rough-turning, facing and back-facing a cylinder head flange. The cylinder head is gripped in an air chuck on a rough surface. Alignment of the head is checked with a special fixture in the tailstock. The capstan handwheel permits quick movement of the fixture to and from the work. Tool blocks, designed for the job, on front and rear of cross slide hold the turning and forming tools. Part of the operation is done with the front tools, then the feed is reversed in the apron; the slide traversed so that the rear tool does its operation, with power feed, and working to the automatic diameter stop. Production figures are censored, of course, but you'd be amazed at the number of cylinders these operators turn per shift, on this Monarch 18″ Model BB Lathe.

SAVES NEW MACHINE TOOLS

Instead of waiting for special machine tools, this manufacturer teamed up his ingenuity with the Monarch representative's knowledge of what Monarch lathes could do. Together, they came up with solutions that have much to do with the speed of our aircraft engine production. Details of how Monarch lathes have been adapted to unusual duties are given in the picture captions.

This kind of careful job analysis may be helpful to you, too. Often, it is possible to adapt our standard engine lathes to work which may, on routine inspection, call for some other type of tool. Precious production time is thus saved . . . and equally important, machines are released for other work.

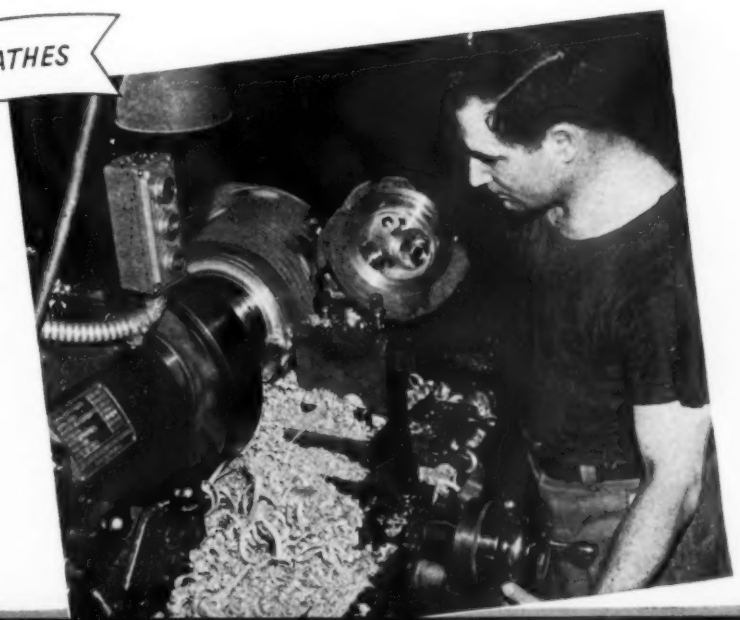
If you think a Monarch representative, with his knowledge of what Monarch lathes can do, might help you step up production of your war work, we are at your command. At Monarch, such service is the "order of the day."

THE MONARCH MACHINE TOOL COMPANY · · · SIDNEY · OHIO

MONARCH LATHES

COVER THE TURNING FIELD

Faster for Fighters WITH MONARCH LATHES



This operator finish-turns and finish-faces cylinder head flange. The head is threaded on an adapter plate, which is mounted on a tee-slotted and balanced face plate. A special tool block, holding a tungsten carbide tool in front, is fed in under power feed to an automatic diameter stop, facing and forming the upper diameters.

YOU CAN START *right here!*

to BOOST your output of Stainless parts and REDUCE your Stainless Steel scrap loss!

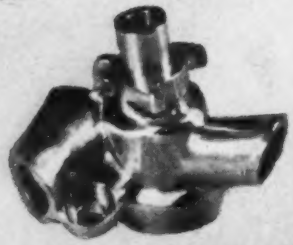
TODAY, there are two big questions in the minds of users of Stainless Steel . . .

"How to increase production of Stainless parts?" and *"How to reduce Stainless Steel scrap loss?"*

On these pages are useful hints to help you answer both questions. Read them carefully. Use them to help you do a trouble-shooting job in the production of Stainless parts. Add them to your own "know how" that has come from working out Stainless fabricating problems.

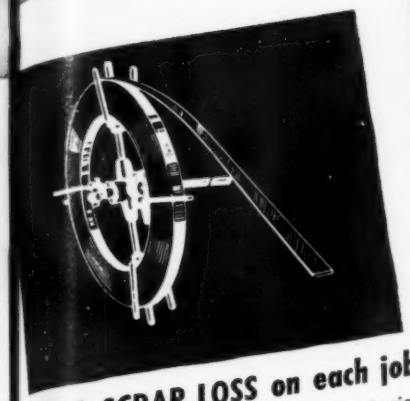
These suggestions are a result of the work Carpenter metallurgists and service men have done in many plants where Stainless is used. Much of their experience is now being made available to you in printed form. And through correspondence with the mill, you can get still more help with your specific problems involving the use and fabrication of Stainless Steel.

THE CARPENTER STEEL COMPANY, 105 BERN STREET, READING, PA.



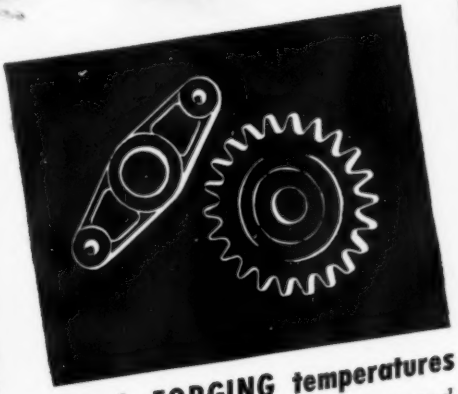
Difficulties in *forging* Stainless Steel fuel supply valve bodies were overcome by making sure that the bars were *thoroughly* heated before the forging operation.

Specifying *narrow* Stainless Strip reduced scrap loss in making this vacuum disc. And the *uniform gauge* of the Strip helped to eliminate production kinks.



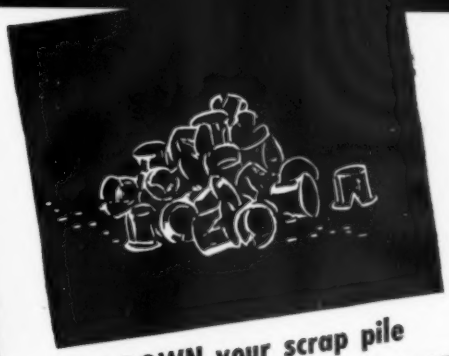
Check SCRAP LOSS on each job

One plant reports a 40% material saving by switching from sheet to Stainless Strip that comes in coils. If you are forming or stamping parts from sheet, find out if a narrow Stainless Strip of the proper width could help you eliminate slitting and the time spent handling sheet.



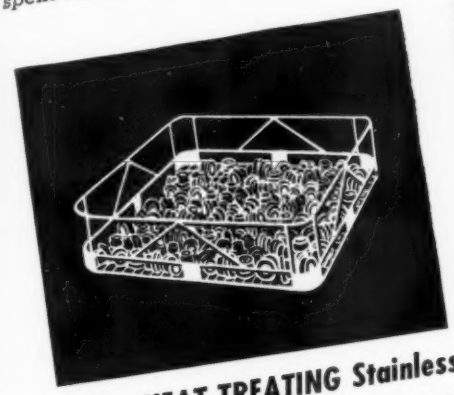
Watch FORGING temperatures

Always run furnaces at the recommended forging temperatures, not hotter. To keep operations going full speed, it may be possible to heat more bars and billets at the same time. Stainless Steels heat more slowly than other steels. So thorough heating of Stainless bars can help to reduce rejects considerably.



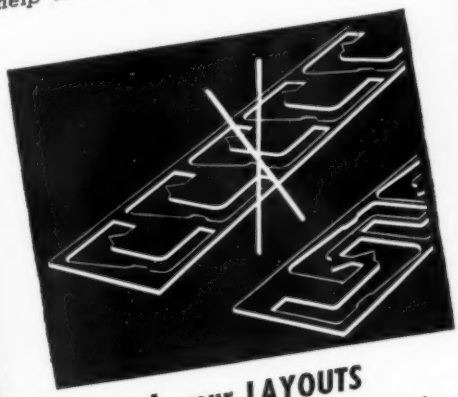
CUT DOWN your scrap pile

When rejects are high it pays to gauge your stock. Material that is not uniform throughout may be the answer to a high percentage of rejects. Undersize material can cause wrinkling in the die. Tearing and galling can result from using oversize material. Gauge your stock for answers to fewer rejects!



When HEAT TREATING Stainless

. . . be sure that all Stainless parts are absolutely clean—free from any grease or foreign matter—before putting them into the furnace. This will help you avoid excess scale, and cut pickling time to a minimum. And remember that medium or heavy sections should be soaked at the hardening temperature.



Re-check your LAYOUTS

Another way to conserve Stainless Steel is to re-check layouts on jobs that are stamped from Stainless Strip. The results will be well worthwhile, in terms of metal conserved and time saved. In some plants, skeleton scrap losses on stamping jobs have been reduced by as much as 20%.

Are You SOLDERING Stainless?

If so, remember that heat is absorbed more slowly by Stainless. Thus, a larger and heavier iron should be used. It is not necessary that the iron be hotter, just larger with more heat capacity to allow the solder to flow more freely. Thorough cleaning of the Stainless surface before soldering is a must!

Here is practical engineering information to help you get the most from every pound of Stainless Steel. This 98-page book, "Working Data for Carpenter Stainless Steels", contains helpful fabricating hints. It can provide you with detailed data about Stainless Steels to meet government specifications and to solve heat or corrosion resistance problems.

This Working Data book is available to users of Stainless Steel in the U. S. A. If you would like the "know how" information it contains, a note on your company letterhead will start a copy on its way.

Carpenter STAINLESS STEELS

BRANCHES AT Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

MAKE IT FIT TO FIGHT

"FROM THE HALLS OF MONTEZUMA TO THE SHORES OF TRIPOLI"

WHEREVER our fighting forces may go, they need equipment —dependable equipment—*fit to fight!* And lots of it!

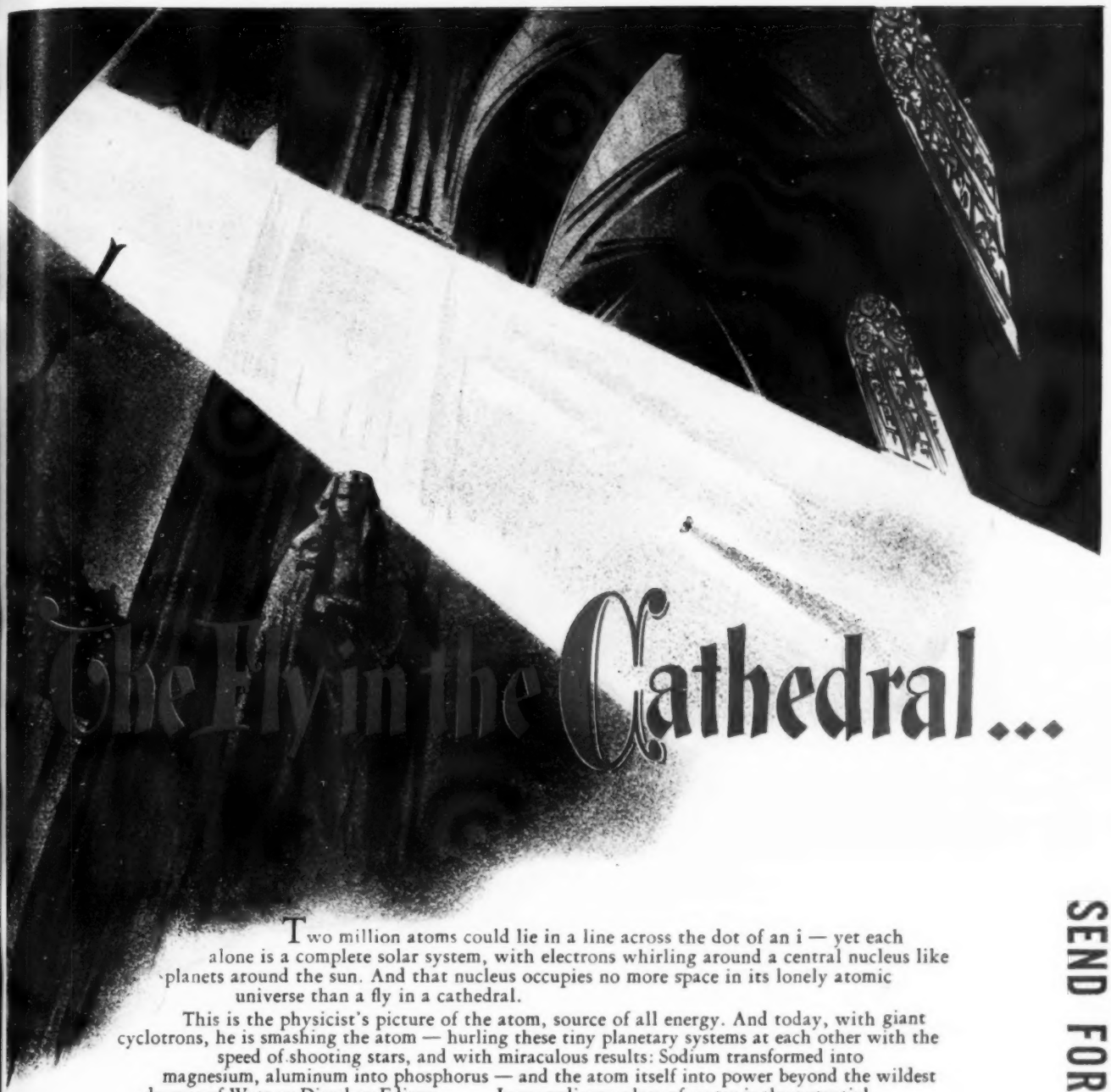
Interchangeable parts, produced in rapid succession and within close limits of accuracy, are the lifeblood of the mass production which America depends upon for Victory. With their extreme rigidity to maintain accuracy at high speeds, Gisholt Turret Lathes are performing with outstanding success in war plants everywhere.

GISHOLT MACHINE COMPANY
1201 East Washington Ave., Madison, Wisconsin

The Army-Navy "E" and the Treasury Flag fly side by side at Gisholt.

GISHOLT

LOOK AHEAD . . . KEEP AHEAD . . .
With Gisholt Improvements in Metal Turning



The Fly in the Cathedral...

Two million atoms could lie in a line across the dot of an i — yet each alone is a complete solar system, with electrons whirling around a central nucleus like planets around the sun. And that nucleus occupies no more space in its lonely atomic universe than a fly in a cathedral.

This is the physicist's picture of the atom, source of all energy. And today, with giant cyclotrons, he is smashing the atom — hurling these tiny planetary systems at each other with the speed of shooting stars, and with miraculous results: Sodium transformed into magnesium, aluminum into phosphorus — and the atom itself into power beyond the wildest dreams of Watt or Diesel or Edison. . . . In an ordinary glass of water is the potential power of a billion kilowatt hours!

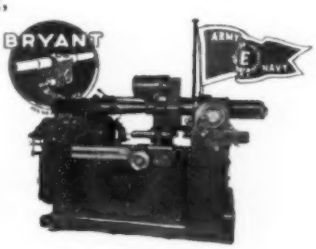
When will industry be able to harness atomic power? Possibly in six months, six years, or not for six decades, but of this you can be certain: One day, just as sure as the earth revolves about the sun, every form of power machinery in use today will be totally obsolete.

This story of atomic power is only an extreme illustration of the problems that industry faces as a result of *change*.

Today, we are living in the midst of far greater and swifter change than the average business is prepared for. As a result, many businesses — seemingly on the rise — are actually on the brink of failure in the new world of post-war production.

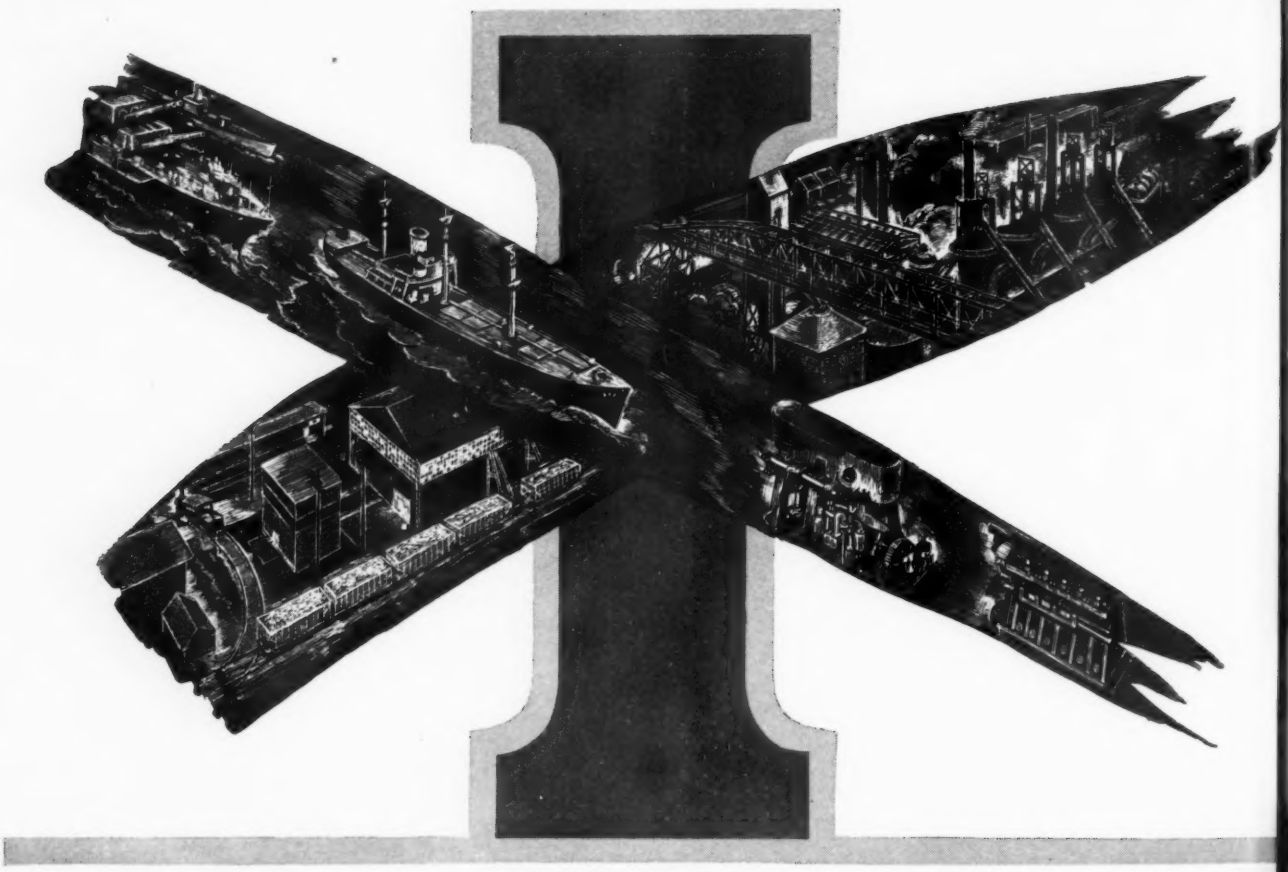
If your business is manufacturing with metal . . . and if you are planning ahead now . . . there is one thing that you can do to protect your business against failure to keep pace with changing methods of production: Consult with the leading *specialists* in machine tool engineering!

In the vast and highly specialized field of internal grinding, there is Bryant! Call upon us now!



Bryant Chucking Grinder Company
SPRINGFIELD, VERMONT, U. S. A.

SEND FOR THE MAN FROM BRYANT



THERE ISN'T AN "I" IN COOPERATE

In the days before America rolled up its sleeves a tall, dark, personal pronoun became the most-used word in the land. A pompous, self-centered word—"I". • Then the shooting started. And we business people and government people and laboring people and professional people and army-navy-air and marine corps people set ourselves to cooperate, to win our war. And that's a job too big and too important for any "I". • Here in Hamilton, we're posting a sign in our offices and workshops, alongside of our "Buy War Bonds" posters. You're welcome to make one just like it, too. It reads, simply—There isn't an "I" in "COOPERATE".

GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

THE NILES TOOL WORKS CO.

THE HOOVEN, OWENS, RENTSCHLER CO.

GENERAL MACHINERY ORDNANCE CORPORATION

AUTOMATIC CHUCKING EQUIPMENT

contributes to today's most urgent production needs

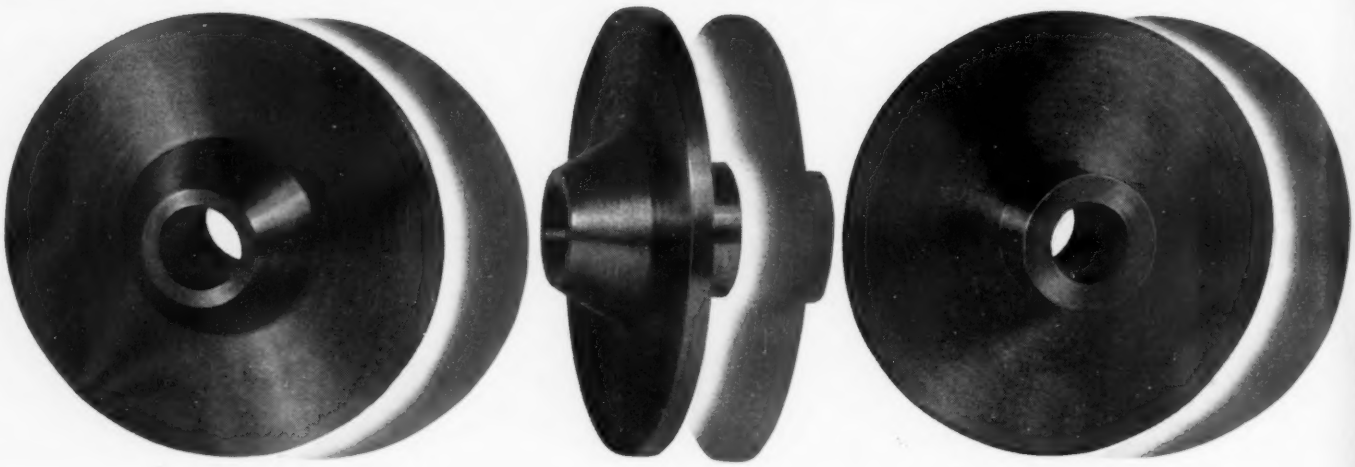
Whether it is parts for airplanes, airplane engines, tanks, Borfors guns, anti-aircraft guns, machine guns, shell adaptors, the American Oerlikon gun or other of the implements urgently needed for the great war effort, P&J machines are meeting the call—accurately, at top speed. The flexibility of Potter & Johnston Chucking Equipment, the versatility of the tooling possible and the ease and convenience with which a wide range of operations can be handled are outstanding advantages which enable P&J machines to make valuable contributions to more and better work in the battle of production.

THE POTTER & JOHNSTON MACHINE CO.

Pawtucket, R. I.

Photo by U.S. ARMY Signal Corps

TERNSTEDT MANUFACTURING INSTALLS MODEL A CLEVELAND *Single Spindle* AUTOMATICS TO PRODUCE SMALL LOTS, SHORT RUNS OF PARTS



● Here is a typical instance of the Ternstedt problems involving *small lots and short runs* of special parts for special purposes. This piece may be termed a "special fitting." It is made on a 3¾-inch Model A Cleveland. Operations consist of rough forming and centering, finish form and drilling, reaming, facing and cutting off. Bar stock of 3⁹⁄₁₆-inch diameter is used. Before machining, part weighs 2.81⅝ lbs.; after machining, ½-lb. Tolerances are easily held.

Another instance? A bushing which requires the following operations: forming and centering, drilling and facing, reaming and cutting off. Again tolerances are easily held. This part is cut from 1⁵⁄₁₆-inch bar stock on a 2½-inch capacity Model A Cleveland.

Combining several separate operations of hand-screw machines in the Cleveland *Single Spindle* Automatic, and frequently eliminating second operation machines from the production cycle, that is good manufacturing practice. *And it is a vital war-time production practice,* especially where quantities are small of each part.

These new Clevelands have all the old characteristic advantages always associated with their name. Strong, clean design; sturdily built; easily controlled by the operator. Easily tooled up and accessible for adjustments. Cleveland Model A is built in 1⅛-inch to 8-inch capacities, with 3¾-inch to 8-inch sizes equipped with 4-speed motor drive, universal camming and variable tool feed. In 1⅛-inch to 2½-inch sizes, constant speed drive is standard, 2-speed drive optional at slight extra cost. Detailed descriptive Bulletin of the size interesting to you will be sent on request.

★ ★ **SERVICE, SKILL, ACCOMPLISHMENT**

The loyalty, diligence and skill of the men and women workers of The Cleveland Automatic Machine Co. have been recognized with an Army-Navy Award for excellence in production.

★ ★

THE CLEVELAND AUTOMATIC MACHINE COMPANY

2269 ASHLAND ROAD · CLEVELAND, OHIO

Sales Offices: CHICAGO: 20 North Wacker Drive, Civic Opera Bldg., Room 1408
DETROIT: 540 New Center Building · NEWARK: 702 American Insurance Building · CINCINNATI: 507 American Building

. . . By using CLEVELAND *single spindle* automatics the increased production obtained from them may release a number of other critical machine tools for other purposes.

CLEVELAND *Single Spindle* AUTOMATICS

MODEL A—Built in 1 1/16-inch to 9 1/2-inch capacities inclusive

MODEL B—Built in 1 1/16-inch to 2 1/2-inch capacities inclusive

Horton chucks

INDEPENDENT Solid Reversible Jaws Only

SCROLL UNIVERSAL Two-Piece Jaws Only

For Use With Intermediate Plates On Threaded Spindles

For Key Drive Tapered Nose Spindles

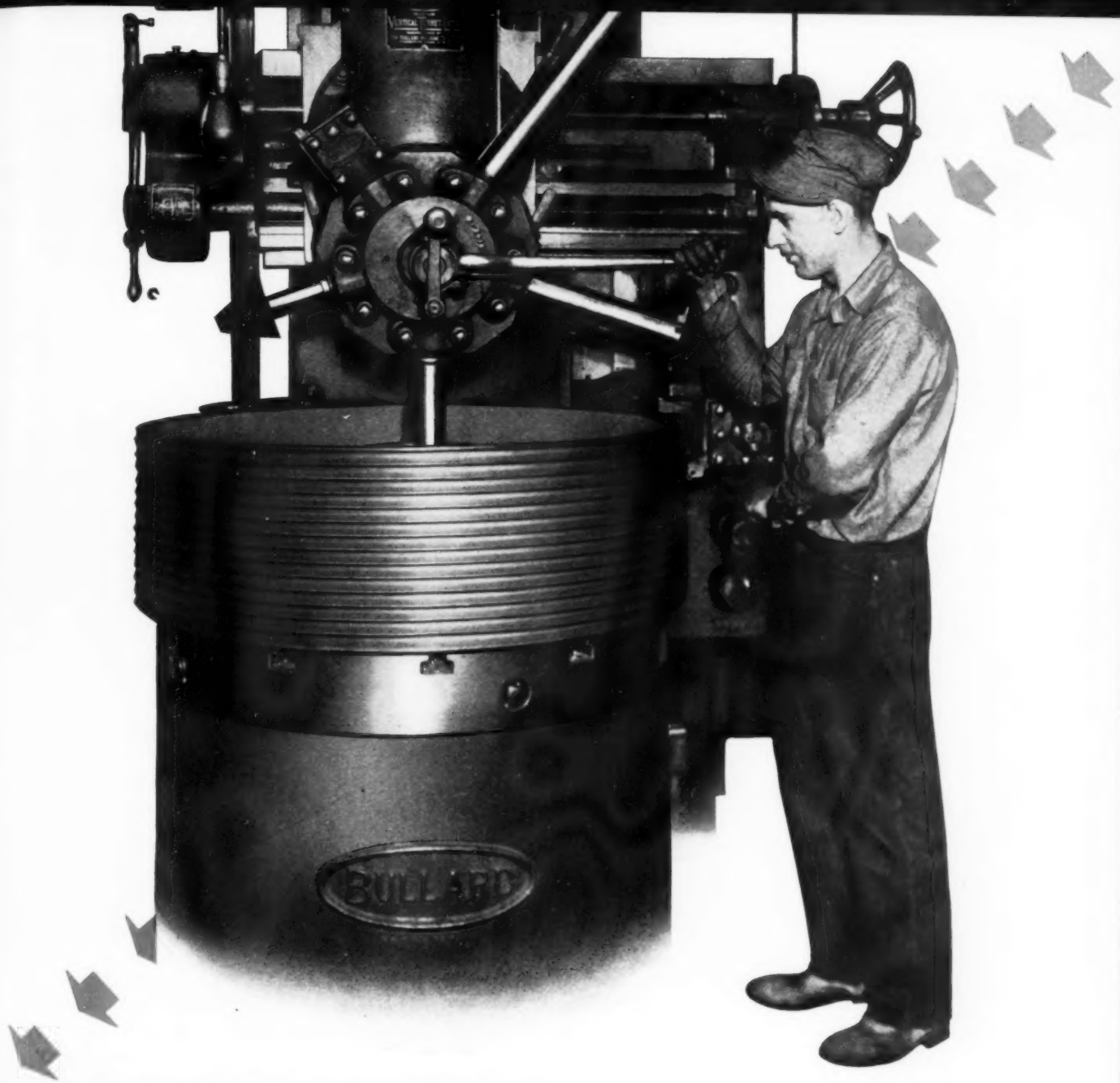
War Production Limited To These Essential Chucks

For Flanged Tapered Nose Spindles
Illustration shows chuck for Type D (Cam Lock) Spindle

FACE PLATE and BORING MILL JAWS—Steel Body Only

HORTON
MORROW

SINCE 1851 .... THE E. HORTON & SON CO.
WINDSOR LOCKS, CONNECTICUT, U. S. A.



BULLARD FOR BIG JOBS...

ARMY E NAVY

We like to feel *our* Army-Navy "E" award is for work that is helping our customers to earn their "E" too.

The big job **may mean big parts — or super-accuracy — or meeting impossible production schedules.**

Whichever it is, your Bullard Vertical Turret Lathe is your best friend, now when you are battling Hitler, and later when the only enemy is a competitor.

Bullard V.T.L.s have these characteristics
Vertical Design • Rigidity and Power for Carbide Tools • 5-Face Turret on Main Head • Centralized Control • Rapid Powe Traverse of Main Head • 4-Tool Turret on Side Head • Simultaneous and Independent Head Functions

THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

THE ANSWER TO THE GRINDING OR HONING PROBLEM THAT HAS BEEN RETARDING YOUR PRODUCTION MAY BE FOUND IN THIS HELPFUL LITERATURE

FREE! **FREE!**

Send for it TODAY
. . . it's FREE!

In addition, you are cordially invited to use our engineering service.

Let our trained abrasive specialists solve your problem for you ...THAT'S ALSO FREE!

Mid-West

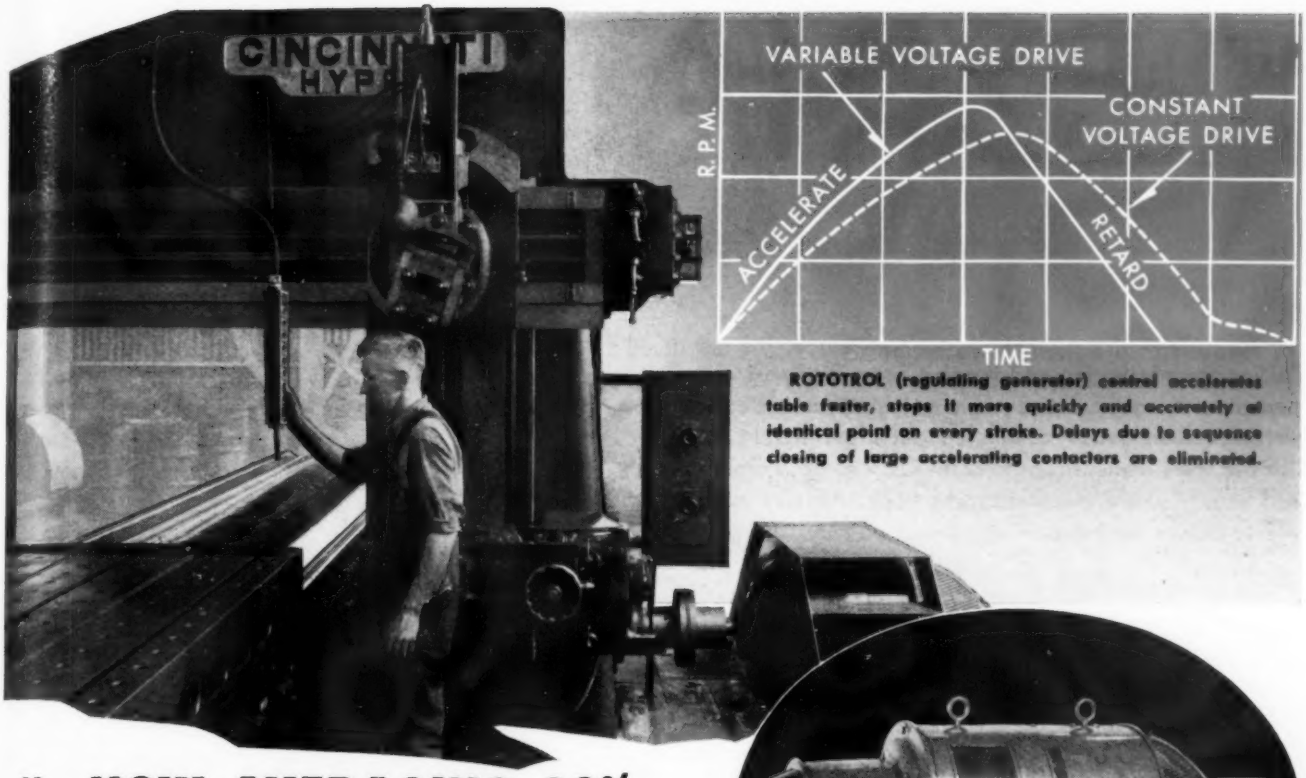
FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

MID-WEST ABRASIVE COMPANY

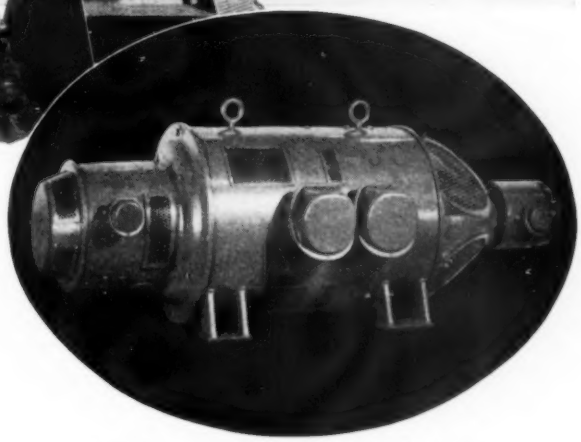
Manufacturers of DEPENDABLE Abrasives

1960 E. MILWAUKEE AVENUE DETROIT, MICHIGAN

MID-WEST ABRASIVES



ROTOTROL (regulating generator) control accelerates table faster, stops it more quickly and accurately at identical point on every stroke. Delays due to sequence closing of large accelerating contactors are eliminated.



Four-in-one rotating unit of Variable Voltage Drive combines induction motor, variable voltage generator, exciter generator and ROTOTROL all on the same shaft. Separate cabinet houses simplified control panel.

"...NOW AVERAGING 30% (OR MORE) HIGHER PLANER PRODUCTION"

...thanks to ROTOTROL...new Westinghouse control

Cuts faster—returns faster! ROTOTROL—the heart of the Westinghouse Variable Voltage Planer Drive—speeds up return strokes, gives more cutting strokes per minute—with accuracy and flexibility not obtainable by any conventional control!

ROTOTROL—the Westinghouse patented control scheme—is responsible for the high rate of acceleration and retardation of the planer drive and the correspondingly greater output. The Rototrol circuit responds instantly to any change in load. As a result, planer motor speed is held constant over the entire speed range. Regenerative braking permits the table to be stopped and reversed at the precise same point every time—permitting planing up to shoulders or in blind pockets.

At the same time, a *wider* speed range (40 to 1200 rpm planer motor speed) permits cutting and return speeds to be adjusted more flexibly to the needs of the job—whether high precision die work or rough bedplate machining.

Ask your Westinghouse representative or write today for full details on this simpler, faster planer drive! Address Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-21204

Westinghouse VARIABLE VOLTAGE DRIVES

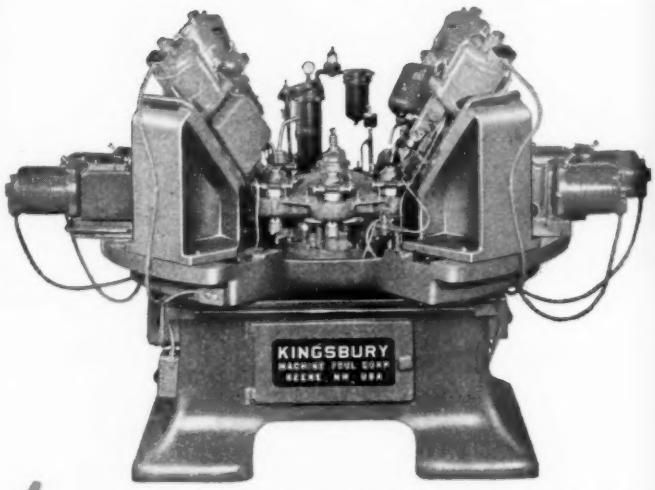
FLEXIMATIC

Demonstrates its Speed and Accuracy on Fuse Part Production

Drilling, counterboring and tapping brass fuse part components—doing the entire job in a single chucking of the work—producing 500 completed parts per hour! Jobs like this, that demonstrate FLEXIMATIC speed, simplicity and accuracy, are the reason why FLEXIMATICS are so widely chosen for intricate operations on munitions parts.

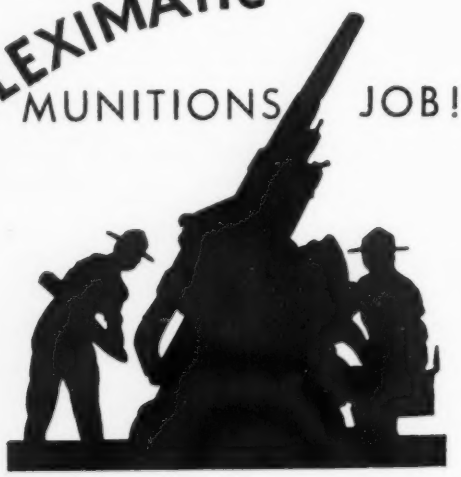
Kingsbury FLEXIMATICS are made up of standard units mounted on one of several types of standard bases. This method greatly lowers the cost of special machine construction and, in addition, permits changes to be readily made to meet changes in production. In the FLEXIMATIC illustrated, individual work holding fixtures in the turret are automatically indexed during the indexing of the main turret, thus presenting the part in various positions at the work stations so that all the operations are performed in a single chucking.

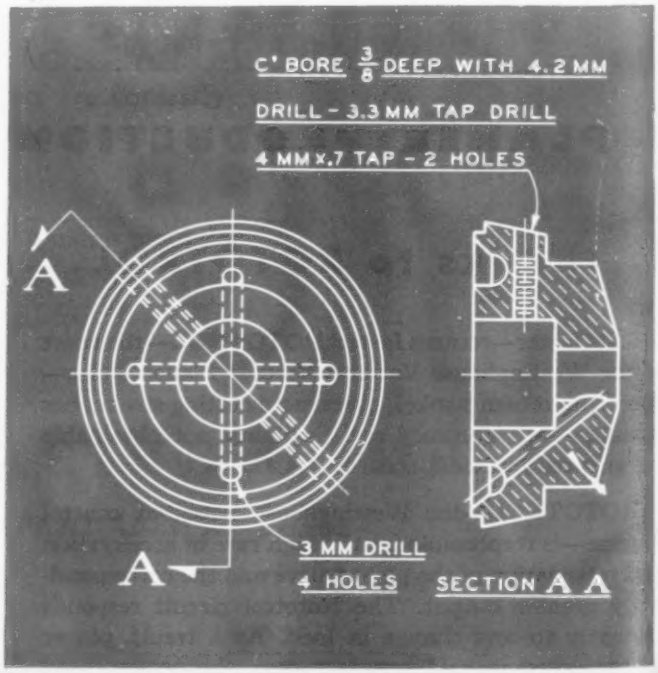
To meet the exacting standards of accuracy and the imperative need for speed in munitions production, choose FLEXIMATICS by Kingsbury!



by KINGSBURY

THIS IS A FLEXIMATIC MUNITIONS JOB!





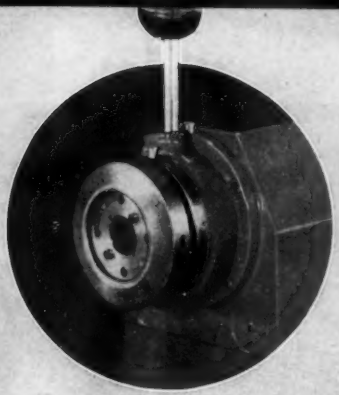
KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U S A

RIVETT

918 HAND SCREW MACHINE

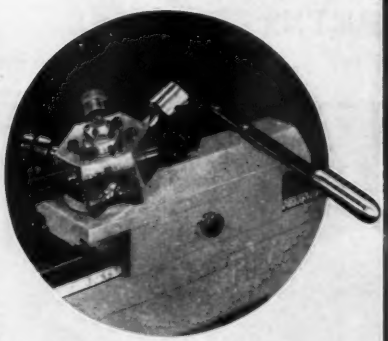
Capable of Thousands of Jobs Now Produced on Heavy, Costly Machines



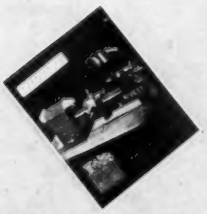
Rotary Chuck Closer

Push-Out Collet Adaptor

Slide Rest Turret Post



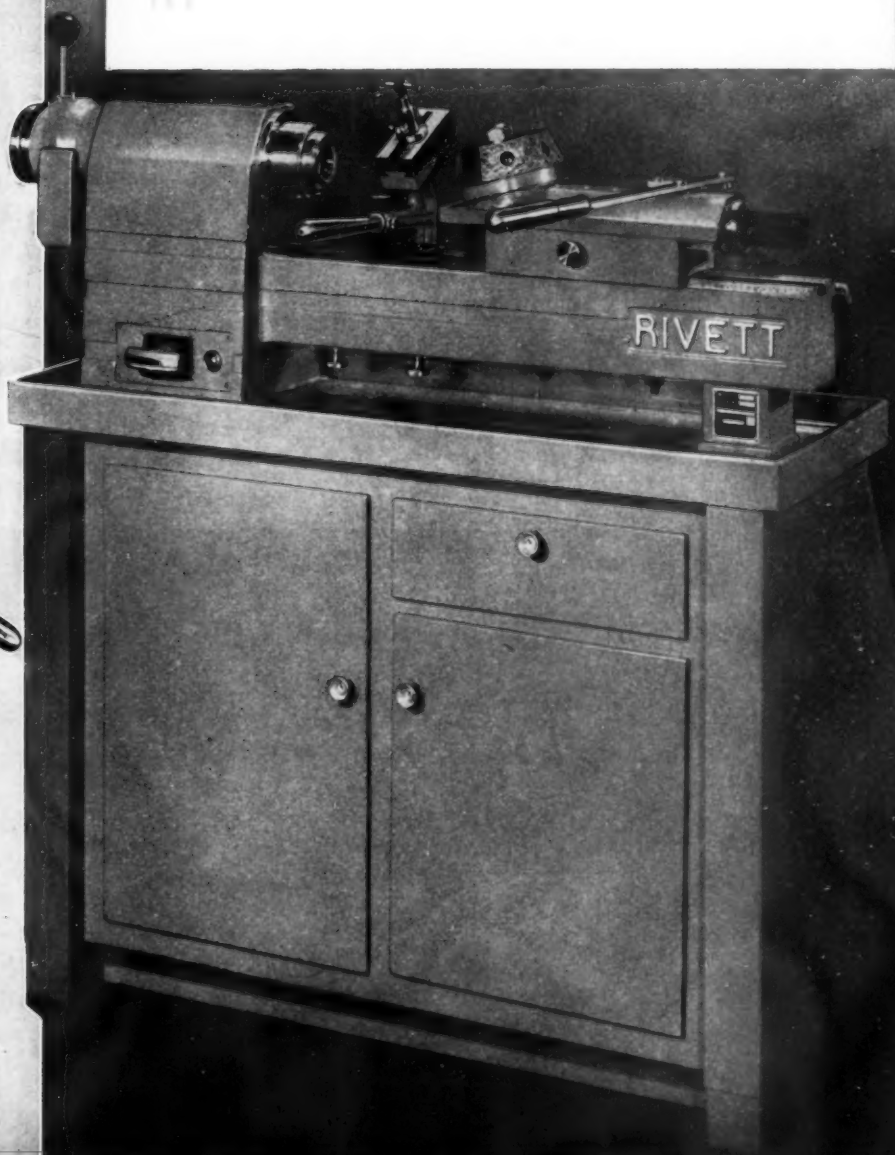
Six Station Turret



For Further Description Write for Bulletin 918

The Rivett No. 918 Hand Screw Machine incorporates precision, balanced design and operating features to make it an efficient producer on small duplicate parts. Work requiring up to eight successive operations can be finish-machined at one chucking. Bar stock passed through spindle may be held in push-out collet, while work individually chucked may be held in draw-in collet, step chuck or jaw chuck. In combination with six turret operations, double tool slide may be set up for straight or taper turning, forming or cutting-off.

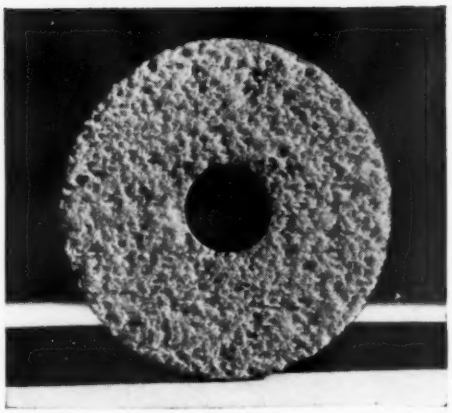
Other combinations are available using chasing bar for internal or external threading, or compound slide rest with turret tool post. Steel cabinet mounting has rimmed top and sump for cutting oil. Bench mounting is optional.



RIVETT LATHE & GRINDER INC.

Which Wheel Structure for YOUR Job . . . *Dense, Medium, Open ?*

MOST ordinary tool and cutter jobs and surfacing jobs require either the fairly dense No. 5 structure or the medium No. 8 structure, the choice being dependent on the size and shape of the tool or part and the area of contact. There are jobs however where the Norton very open, No. 12, structure (illustrated) will be found best, such as:



A No. 12 Structure (open) Wheel

(1) Surface grinding with periphery of wheel of hard, heat-sensitive steels,

(2) Hob grinding, especially when heavy cuts must be taken.

(3) Form tools or other grinding where accurate contours are required, except where acute included angles are involved. (Structure No. 12 wheels, because of their large pores, should not be trued to a sharp, thin point.)

Norton engineers will be glad to study your tool room and surfacing jobs and select the wheel structure which will be best for each one.

NORTON COMPANY • WORCESTER, MASS.

W-899

FIND METAL-CUTTING HORSEPOWER Quickly!

It's Easy with the G-E MOTORULE*

This newly developed load calculator makes it easy to figure the motor horsepower required for metal-cutting operations when the recommendations of the machine builder are unavailable. Its advantages? You can avoid *undermotoring* and save yourself production delays; you can avoid *overmotoring* and save the nation vitally needed steel, copper, and aluminum.

The G-E MOTORULE is accurate for a wide variety of cutting operations on lathes, drills, milling machines, and planers. It works on a wide range of materials, because you start from a convenient table of constants for the material being cut.

The results of many years of work by metal-cutting authorities were used by G-E engineers as a basis for the MOTORULE. The formulas were checked against actual load tests, and leading machine-tool builders were consulted.

The MOTORULE will help you in making sure of adequate motor capacity on machines being put to new war work, and in selecting motors for machines formerly driven from line shafting. To get your MOTORULE, just get in touch with your G-E Motor Representative. Or, if you wish, mail the coupon direct to General Electric, Schenectady, N. Y.

First you refer to a convenient table of constants, printed on each rule, choosing the constant for the particular type of metal to be cut. Then by setting the scales to the known cutting speed, feed, and cut, you arrive at the cutting power required on the basis of ideal tool and machine conditions. Complete instructions are furnished with each MOTORULE.

*The MOTORULE is not intended to supplant the instructions of machine builders as to the power requirements of their machines. It is offered to fill the gap when these recommendations are unavailable.

SPECIFY TRI-CLAD MOTORS

REG. U.S. PAT. OFF.

Standard G-E Motors Are Generally Available without Delay for War Jobs

GENERAL ELECTRIC

General Electric Co.; X 750-159
Schenectady, N. Y.

☐ Please send your MOTOR FITNESS MANUAL, GED-1017.

☐ Please send me a G-E MOTORULE, with full instructions and leaflet giving the principles on which it is based.

Name .....

Company .....

Street .....

City ..... State .....

8030

"PUT IT ON THE BLANCHARD"

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ **Production**

Adaptability

Fixture Saving

Operation Saving

Material Saving

Fine Finish

Flatness

★ **Close Limits**

★

. . . . . ***Especially valuable on jobs like the one illustrated.***

GRINDING BALL BEARING RACES ON THE BLANCHARD NO. 18 SURFACE GRINDER

Steel ball bearing races are ground on the sides on the Blanchard surface grinder, producing parallel surfaces from which other operations are located.

A Blanchard demagnetizer and washing attachment are used to demagnetize and clean the work.

.008 inches of stock are removed from each side of 3 3/8″ ball bearing races to limits of ±.001″ and .0003″ for parallelism.

Blanchard Grinding produces accurate parallel sides — and produces them at a rate of 250 rings (500 surfaces) per hour.

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS.

BLANCHARD

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

HARDINGE

Engineered COLLETS and FEED FINGERS

for Automatics, Chucking Machines and Turret Lathes

OVER 50 YEARS EXPERIENCE provides us with a thorough understanding of all requirements and conditions.

CONCENTRICITY—Special finishing methods assure essential accuracy.

POWER SPRING for quick collet opening.

SURE-GRIP SERRATIONS for maximum grip on bar stock with minimum machine pressure.

CORRECT TENSION—Testing devices guarantee correct tension for each particular hole size.

SPECIAL STEEL for each distinct requirement.

CONTROLLED HEAT TREATMENT means power spring for collets, correct tension for feed fingers and durability for both.

GROUND AFTER HARDENING to assure uniform dimensions.

HARDINGE Collets are also available for all makes of lathes and milling machines.

HARDINGE BROTHERS, Inc., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Twist Drills — Milling Cutters — Reamers — Hobs — Slitting Saws—End Mills—Taps—Dies—Screw Plates —Profile Cutters—
THE TOOLS YOU BUY
AGAIN

Try them on the basis of ASSURED *better performance . . .*

Shop after shop has come to recognize the ruggedness, accuracy and fast cutting action of UNION TOOLS after proving them out on difficult jobs.

There is sound reason for the better performance of these cost cutting tools. One of these reasons is the *experience behind them*—an experience that involves years of research, as well as outstanding technical, metallurgical and manufacturing facilities second to none in the field of small tool production.

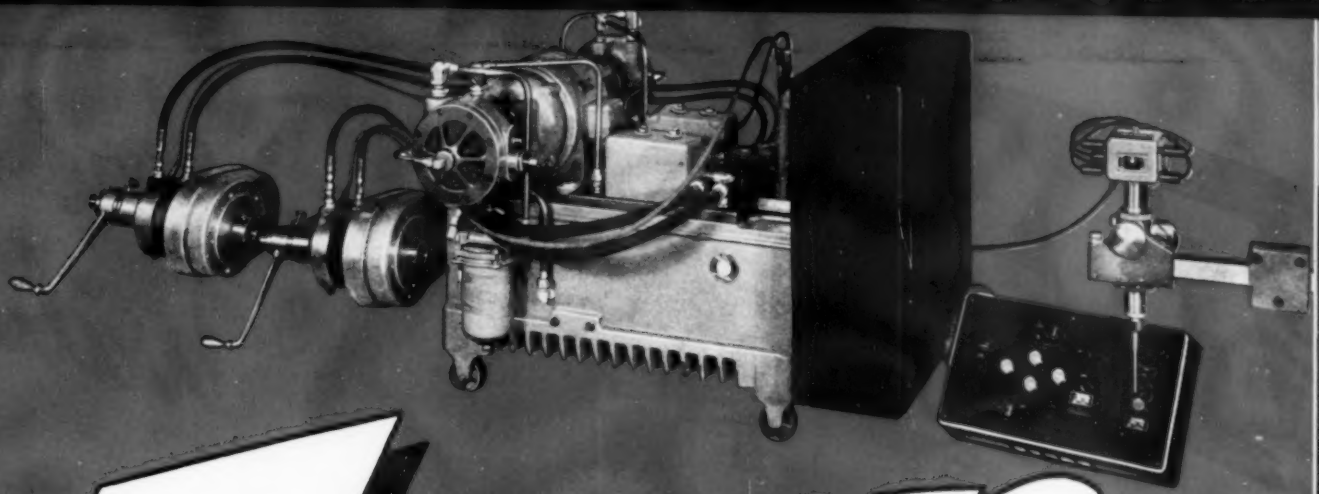
Because Union has the means for producing tools of the finest quality and concentrates every resource on achieving highest performance standards on all tools bearing the name "UNION", users of UNION tools can always be certain of efficient, economical service.

UNION TWIST DRILL CO.
Athol, Mass.

STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 6540 Antoine St.

MANUFACTURING DIVISIONS
S. W. Card Mfg. Co., Div.; Mansfield, Mass.
Butterfield Division, Derby Line, Vt., and Rock Island, Quebec
Representatives throughout the world

UNION



7 TIMES MORE PRODUCTION

from the Machines You're Now Using

DUPLIMATICS—the automatic control for standard machine tools—have established an average increase in production of 7 times the speeds possible with manually controlled machines alone. Accuracies demanded have been easily met; hand finishing has been cut; scrapped parts reduced on *all* kinds of Ordnance work—

TORPEDOES • BOMBS • MACHINE GUNS • AIRPLANE ENGINE PARTS
TANK TURRETS • ANTI-AIRCRAFT GUNS • AIRPLANE LANDING WHEELS

DUPLIMATICS ARE IN THE LARGEST MASS production plants in America, yet their cost is within the reach of smaller production shops.

You use a DUPLIMATIC with your present equipment. It is moved alongside any bottleneck machine—engine or turret lathe, shaper, boring mill, vertical mill—and connected up within the space of one day. The following day the operator of that same machine should increase production by 7 times.

(This is the average; we can give you an estimate when you tell us what the work is.)

AIRCRAFT ENGINE GEARS

32 Gears instead of 4 in 16 man hours! That's the increase with DUPLIMATICS in one plant. Smoother finish, less hand finishing and no scrapped work on this tricky contour turning job. Standard engine lathes—with DUPLIMATICS—are now doing the impossible.

AIRCRAFT ENGINE CONNECTING RODS

Automatic contour milling of airplane engine connecting rod cavities. High speeds and increased accuracies possible with DUPLIMATICS have reduced hand finishing. Specially skilled operators are not needed.

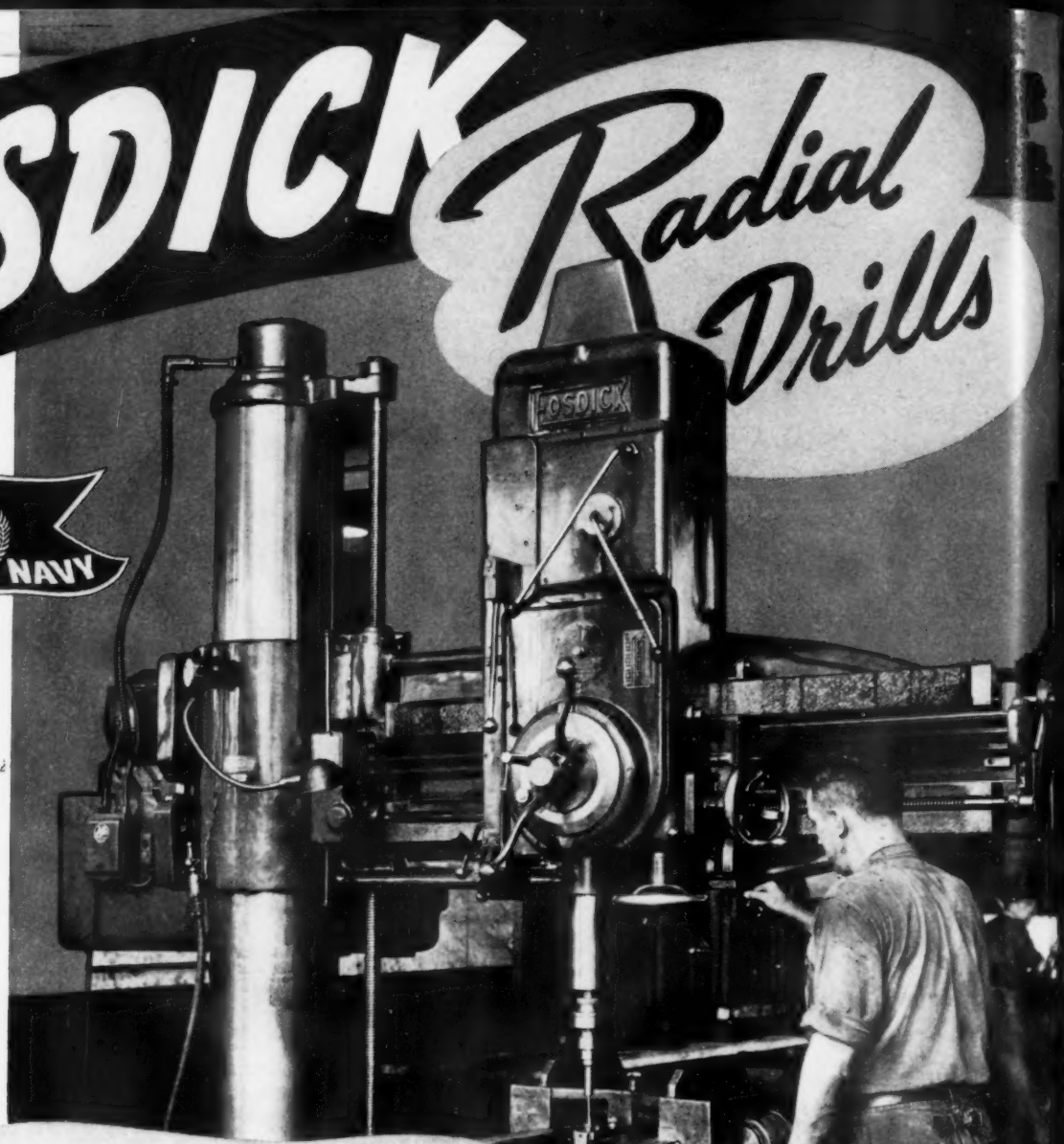
These sketches indicate some of the automatic contouring that can be done on standard machine tools with DUPLIMATICS.

Do your Contour Machining with a DUPLIMATIC and make it AUTOMATIC.

DETROIT UNIVERSAL DUPLICATOR CO.

737 E. Milwaukee Ave. • Detroit, Mich.

FOSDICK Radial Drills



ARMY E NAVY

◆ Complete drilling and tapping operations on these 1290 pound machine base castings are being completed quickly—accurately on this Fosdick Economax Radial Drill. The base casting will shortly develop into a complete grinding machine which will be used to help produce accurate parts for our armed forces abroad.

This is typical of the many jobs Fosdick Economax Radials are doing in hundreds of shops to speed badly needed equipment to our War industries.

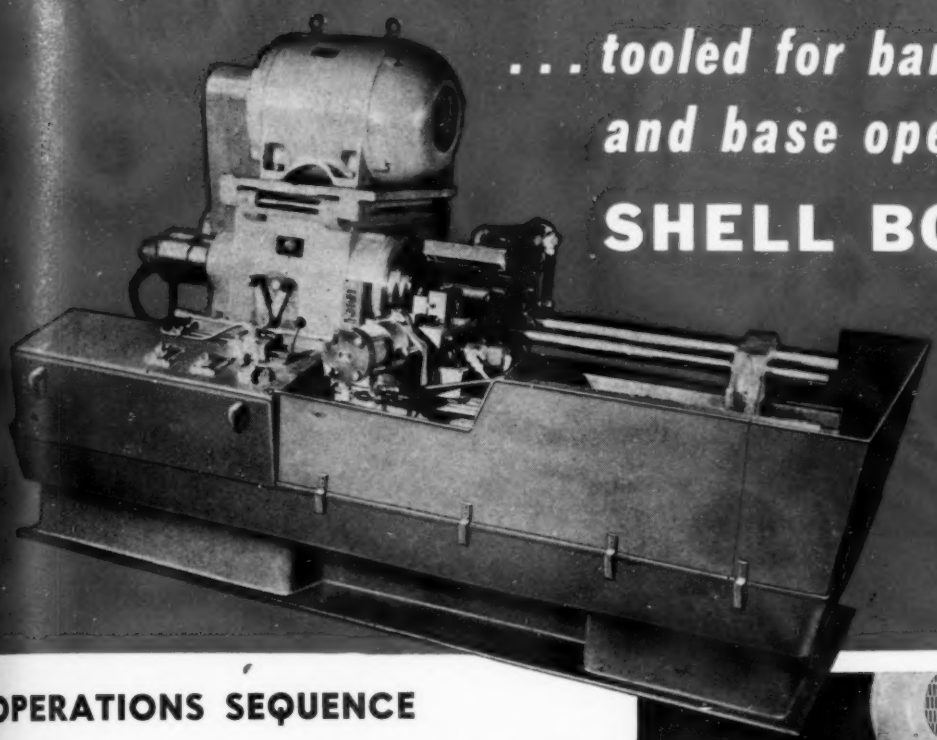
The full hydraulic control by means of a single hydraulic pump—centralization of controls—thirty-six spindle speeds—eighteen feeds and three pipe tap leads all in the head provide ease of operation and facilities for handling a wide variety of work.

Write for complete data contained in Fosdick Radial Drill Bulletin R A.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI ... OHIO

THE NEW SPARKS SEMI-AUTOMATIC HYDRA FEED CHUCKING LATHE

. . . tooled for band grooving and base operations on SHELL BODIES



Versatility of tooling and holding equipment adapt the SPARKS SEMI-AUTOMATIC LATHE for all operations on shell bodies from 75 m/m to 155 m/m inclusive.

High production is assured when the SPARKS is tooled, as shown here, for band groove and base operations on 75 m/m shells.

OPERATIONS SEQUENCE

Front tool cuts band groove, the tools moving into and away from work automatically. Rapid traverse is provided for non-working movements while feed movements are controlled by metering valve.

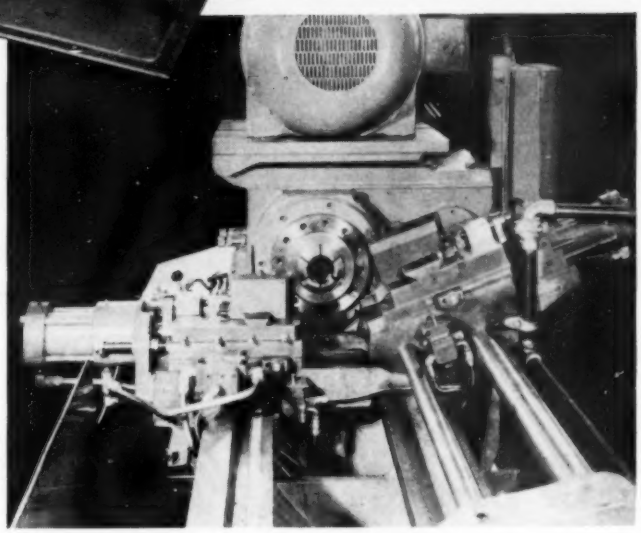
Back tools, timed in sequence with front tool, handle facing and cut-off. Rapid traverse and feed similar to front tool are provided.

Relief of tools on return movements to eliminate tool marks is hydraulically operated and automatic.

All tool movements are automatic. Shifting of manual starting valve handle starts the operations cycle, and automatically operates clutch and brake for spindle starting and stopping.

Quick loading and recovery of shell are handled by another hand valve actuating hydraulically controlled collet jaws.

A simple change of collet and tooling provides for the machining of 90 m/m shells. However, this machine is capable of machining a wide range of parts aside from those involved in armament production.



CONDENSED SPECIFICATIONS

Swing over ways—21″
Swing over carriage—12″
Ball and roller bearing headstock with 4 selective speeds

SEND AT ONCE FOR COMPLETE DETAILS

SPARKS HYDRA-FEED LATHE

SPARKS MACHINE TOOL CORPORATION
NORWALK . . . . CONN.

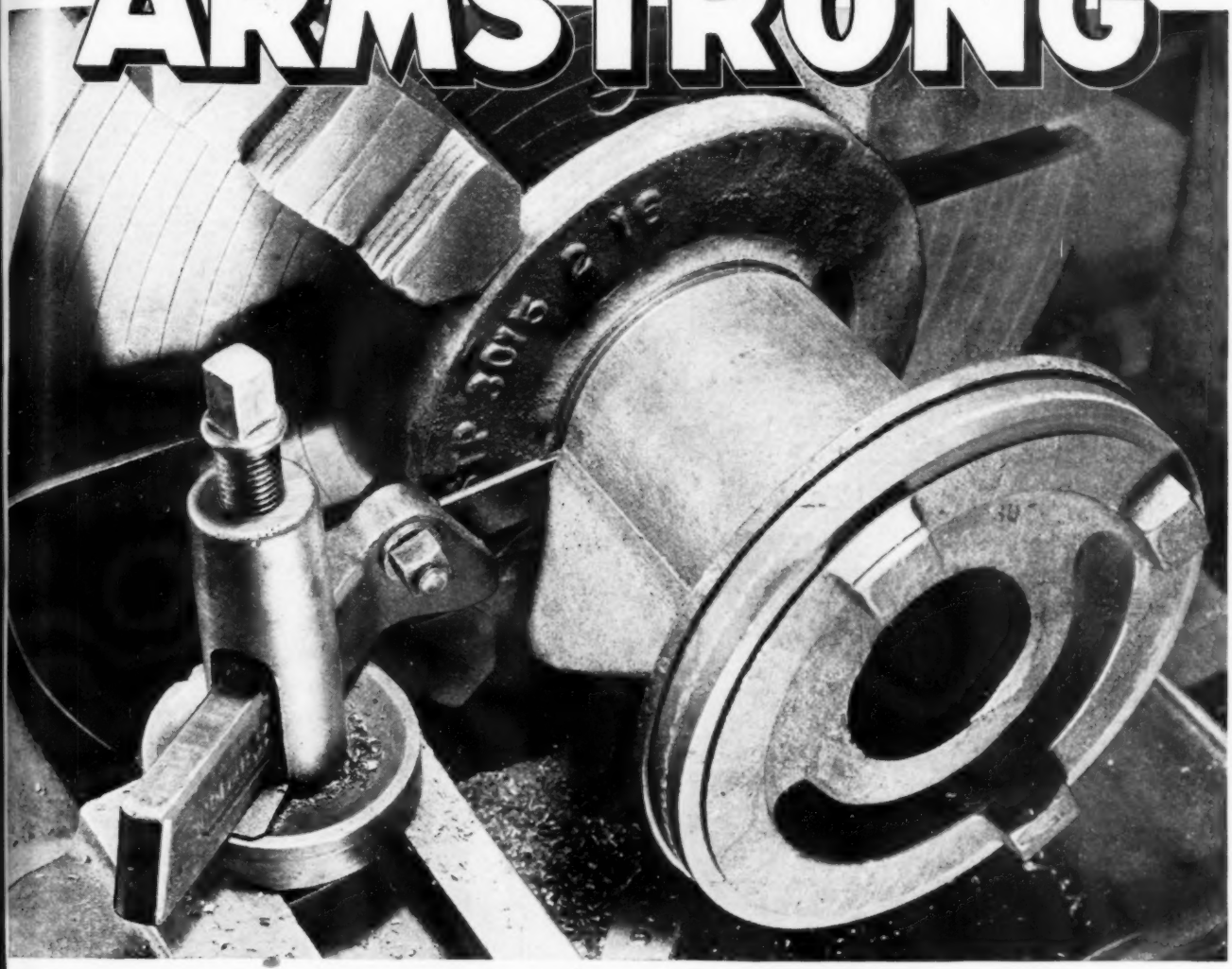
NO. 3 UNIVERSAL TURRET LATHE IS *Easy for Women to Operate*

Because of its light weight, compact and rigid design the Bardons & Oliver No. 3 Universal Turret Lathe responds readily to the quick and sensitive touch of the skilled woman operator. The results are increased speed of production and higher quality of work.

If you are employing women to produce small parts from bars, forgings or castings, and the demand for your product is growing, let us give you further information.

BARDONS & OLIVER, INC. 1133 W. 9th STREET CLEVELAND, OHIO

ARMSTRONG



ARMSTRONG TOOL HOLDERS

simplify "change overs"

In so vast and rapidly moving an undertaking as the present industrial War Program, periodic changes are inevitable — and changes in products mean changes in tooling. For this reason producers of war materials should as far as possible tool-up for today's work in such a way the "change-over" to other work can be made economically and with a minimum loss of production time.

Use ARMSTRONG TOOL HOLDERS for every operation on lathes, planers, slotters and shapers. Each is a permanent, multi-purpose tool that does innumerable operations—does the work of a complete set of forged tools. With ARMSTRONG TOOL HOLDERS a change of tools is simply a change of cutters—a matter of minutes. With ARMSTRONG TOOL HOLDERS you can produce more and cut efficiently at speeds and feeds often double those considered "standard". With ARMSTRONG TOOL HOLDERS you "Save: All Forging, 70% Grinding and 90% High Speed Steel."

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

3 N. FRANCISCO AVE. CHICAGO, U.S.A.

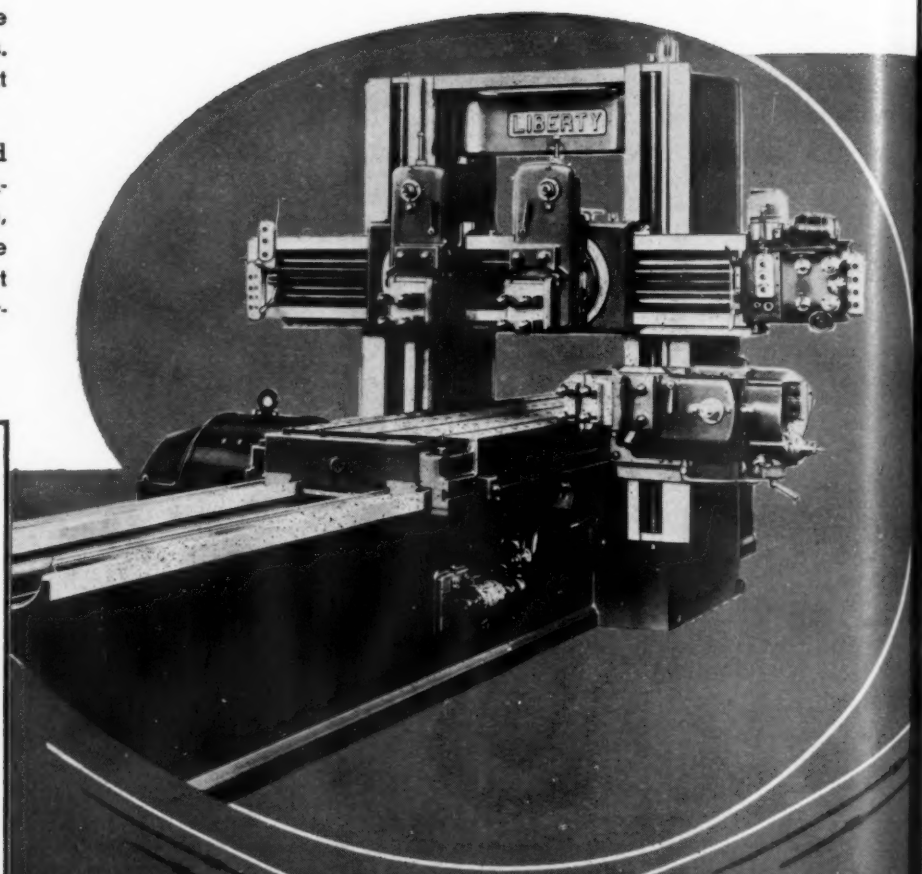
Eastern Warehouse & Sales:
199 Lafayette St., New York

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

LIBERTY PLANERS . . .

Liberty builds Open Side, Double Housing and Convertible Planers. Size range permits selection to suit any planer job.

There is a Liberty Planer to fit and do your work well. Some exceptionally good delivery dates possible, dependent on requirements. Write or call nearest representative or get in touch with factory direct for information and illustrated literature.



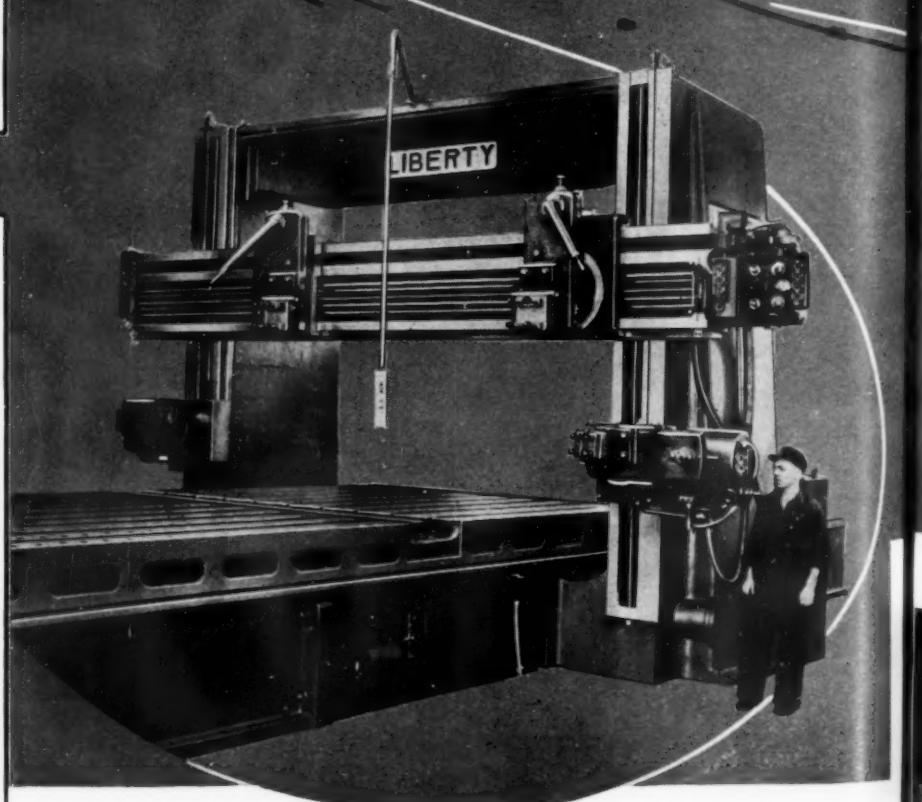
LIBERTY DOUBLE HOUSING PLANERS

Developed to handle high production work within given size ranges, rigidly constructed and featuring the latest type of pyramid housings. Will accommodate one, two, three or four heads and handle precision work with maximum cutting feeds and speeds. The Standard Design and Medium Duty Design planers have rail clamping of the manual type while the Heavy Duty Design machines are equipped with electric motorized clamps. Illustration shows a Heavy Duty planer. Medium Duty machine almost similar in appearance.

Double Housing—Standard Design 22"—24"—30"—36"—42" and 48" sizes.

Double Housing—Medium Duty Design 48"

Double Housing—Heavy Duty Design 36" — 42" — 48" — 54" — 60" — 72" — 84"— 120" and 132" sizes.

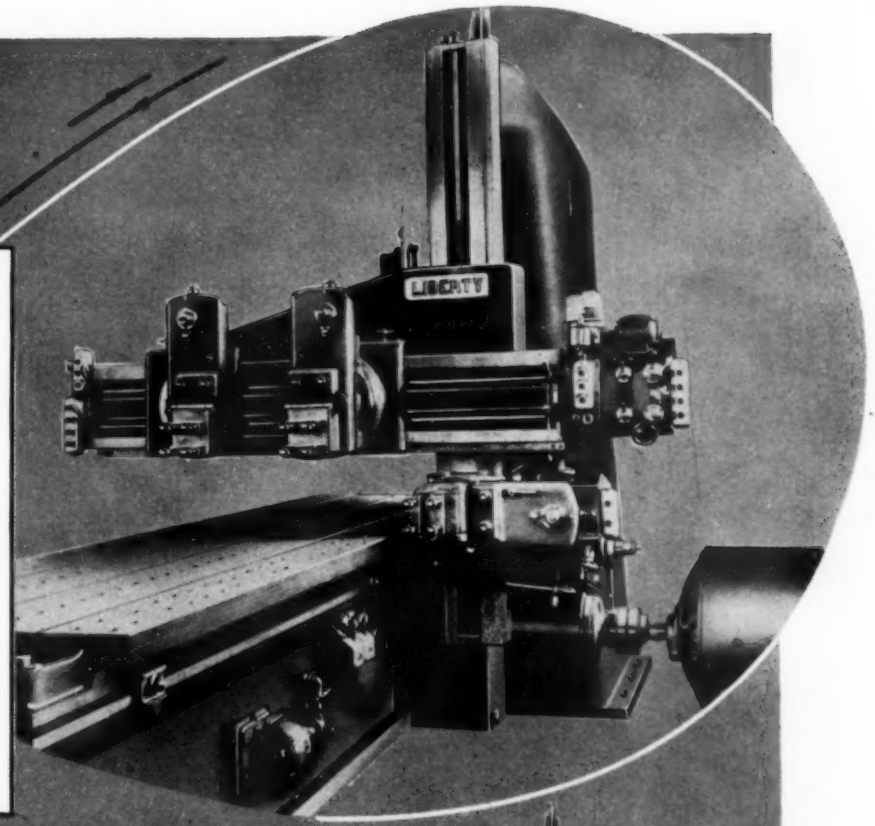


LIBERTY PRODUCTION GIANT PLANERS

The Production Giant is a Double Housing planer built to accommodate large war and industrial work. It is extremely sturdy with latest type pyramid housings. Precision production is handled at maximum cutting feeds and speeds. Dual electric control facilitates operation from either side. Electric feed to all heads with electric infeeds on side heads. Micrometer adjustments on all horizontal and vertical feed rods. These are a few of the many modern features which will benefit the user of the Liberty Production Giant.

Double Housing—Production Giant Planer 132"x84" and 132"x120"

A Size and Type for Every Need

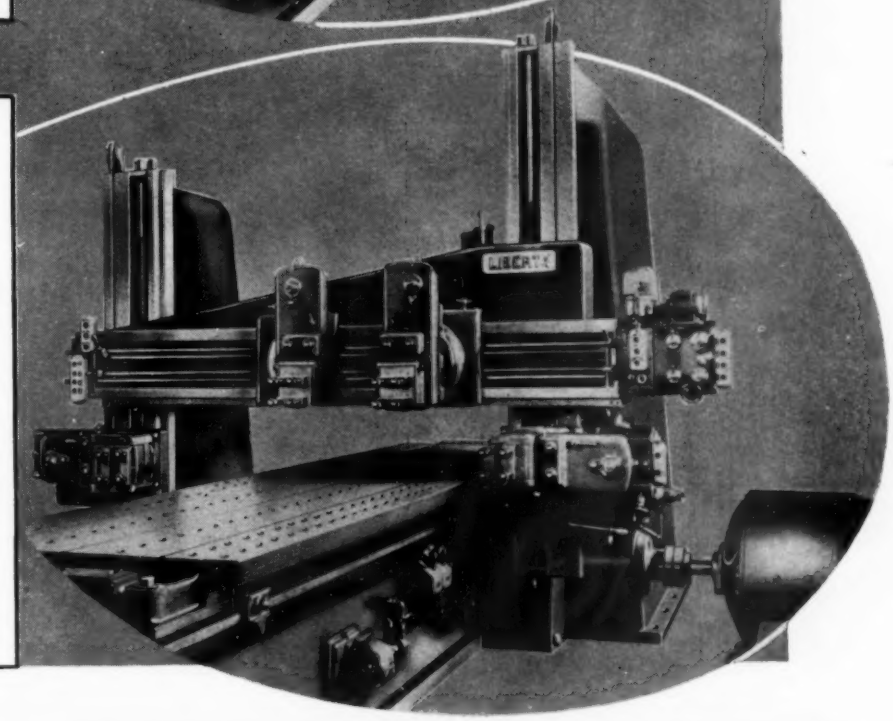


LIBERTY OPEN SIDE PLANERS

Designed and built to accommodate work of variable widths this planer has strong wide faced housing assuring rigidity and accuracy when rough cutting or doing precision finishing. One, two or three heads. Easy operation with simplified control. Heavy Duty Design machines are equipped with motorized rail clamp and trouble free constant lubrication system.

Open Side—Standard Design 24"—30"—36"—42" and 48" sizes.

Open Side—Heavy Duty Design 36"—42"—48"—54"—60" and 72" sizes.



LIBERTY CONVERTIBLE PLANERS

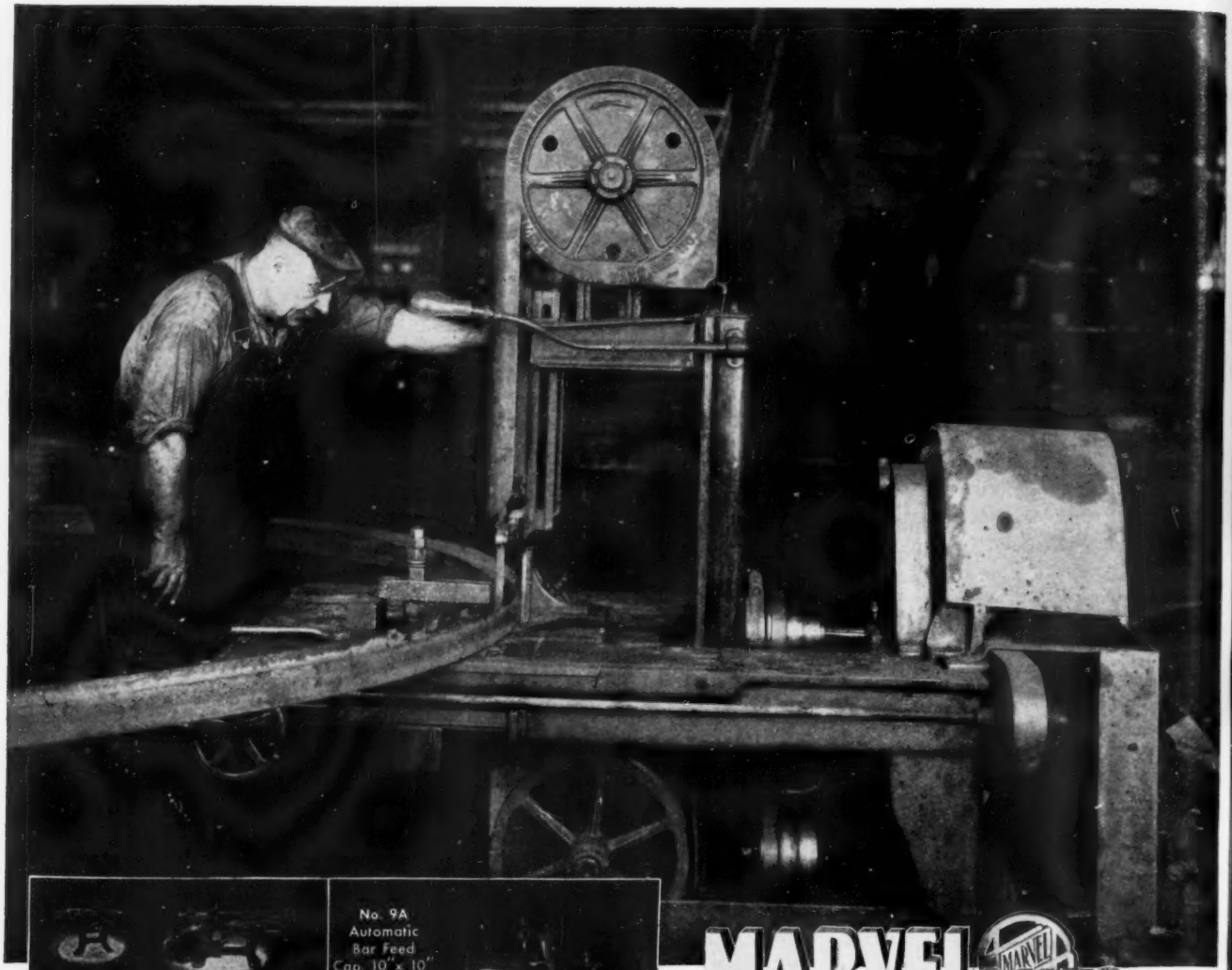
The Liberty Convertible Planer combines the versatility of the Open Side with the rigidity of the Double Housing. Left housing moves in and out permitting use of side heads on unusually narrower work than can be handled with a Double Housing planer of similar capacity.

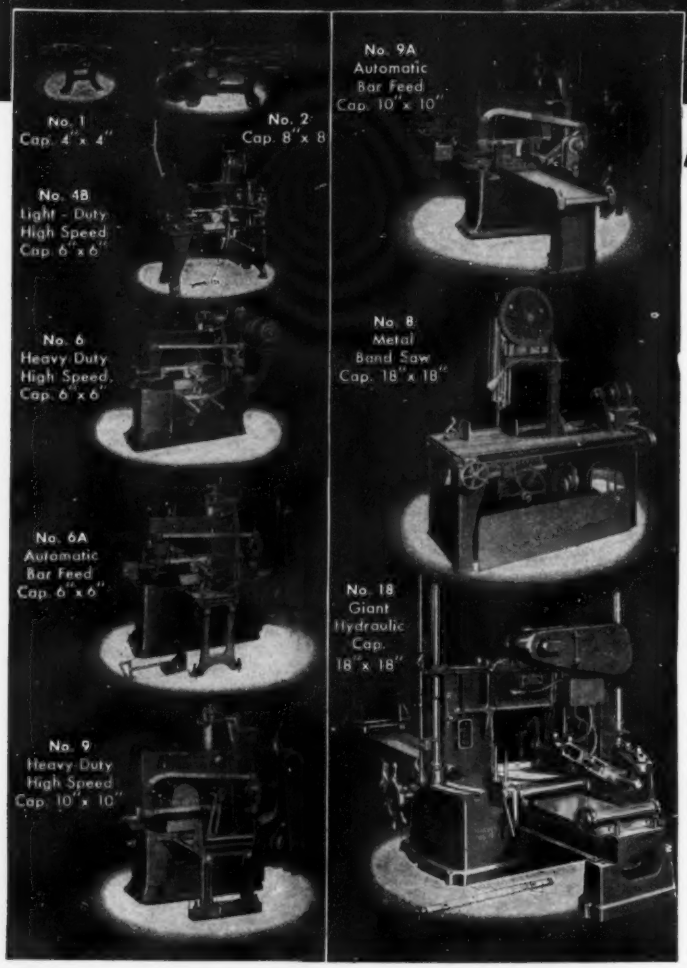
Both the Standard and Heavy Duty Design Convertibles are built in a selective range of sizes. Rails can be furnished to allow as much as 12'—0" between housings.

Convertible—Standard or Heavy Duty Design 36"—42"—48"—54"—60"—72"—84" and 96" sizes.

LIBERTY PLANERS

1006 WELLER AVENUE HAMILTON • OHIO





MARVEL SAWS

How would *you* do it?

(Cutting an I-Beam that has been rolled into a large diameter ring into segments. A typical example of the versatility of the No. 8 MARVEL Band Saw)

At the Kling Bros. Engineering Wks., Chicago, manufacturers of rolled structural shapes, three MARVEL No. 8 Metal-cutting Band Saws are proving "A-1" and "100%". In the MARVEL System there are saws exactly suited to every shop's need—and for structural shapes, the universal MARVEL No. 8 is ideally suited, because it handles all work up to 18" x 18" cross-section and does cutting-off, mitering and notching. The blade feeds into the work at any angle from 45° right to 45° left. It is the most versatile metal-cutting saw built.

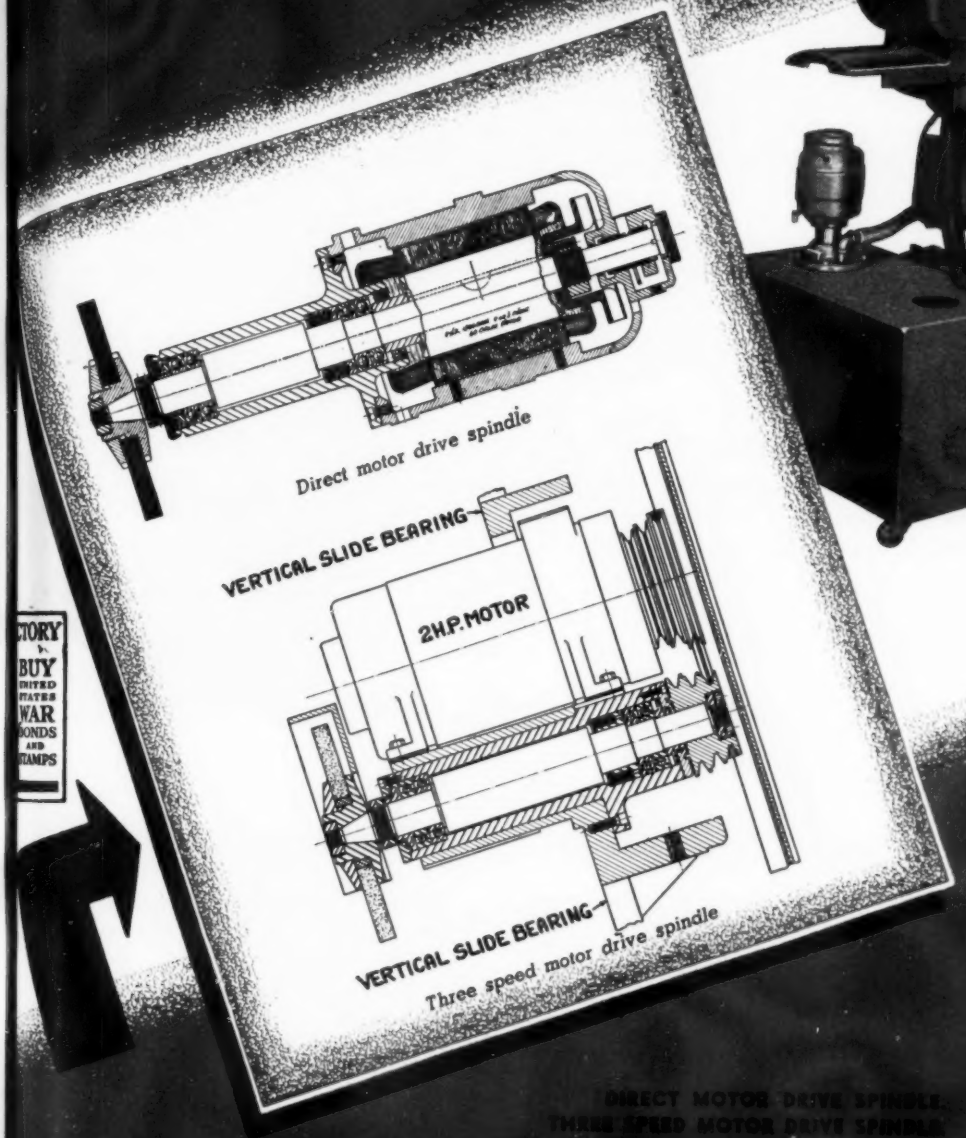
ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave. Chicago, U. S. A.

***Eastern Sales Office:* 225 Lafayette St., New York**

COVEL NO. 5
SURFACE GRINDER



PRODUCTION MUST NOT LAG

America and her allies are just beginning to take the offensive—our armed forces must be assured of getting what they want when they need it most.

Fast, accurate, flexible tools permit rapid production adjustments to meet these ever-changing needs.

Owners know that they can depend on Covel No. 5 Hydraulic Surface Grinders to handle a wide variety of surface grinding jobs accurately, swiftly, profitably.

Covel's bulletin A 33 contains detailed specifications and is yours on request. Write, wire or phone today.

DIRECT MOTOR DRIVE SPINDLE
THREE SPEED MOTOR DRIVE SPINDLE

Illustrated above are the No. 5's Direct Motor Drive Spindle, and Three-speed Motor Drive Spindle also available. Both are fine examples of Covel up-to-the-minute engineering design as incorporated in the long-lived No. 5 Hydraulic Surface Grinder.

PROMPT DELIVERY TO WAR INDUSTRIES
Shorten employee-training time with Covel equipment

Grinding Machinery Since 1874

COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICH.

I'm tellin' you.

No. 7 in a series of tips on "Keeping 'em Turning"
by Jimmy Slevins, over 40 years at LeBlond

USING A CHUCK

Generally speaking, a chuck is used when the piece to be machined is irregular in shape; large in diameter in proportion to its length; so long as to require its being passed through the spindle; or when it is to be bored or drilled on the lathe axis.

On many lathes more than seven years old, there is a threaded spindle which requires some special handling when you put on or take off a chuck. On today's modern lathe this thread has been replaced with a standard taper spindle nose. Here is the procedure for putting on both types.

TAPER SPINDLE NOSE

Simply place chuck on spindle nose with slot (A) fitted over key (B). This leaves both hands free to start and tighten collar (C). On or off the operation takes 12 to 15 seconds and is practically fool-proof.

OLD TYPE THREADED SPINDLE NOSE

Don't put chuck on with the lathe running. It is dangerous to the operator and bad for the thread.

Hold chuck up to nose and revolve spindle by hand until engaged, then run chuck on by hand. If the chuck is too heavy for steady handling, place on a board across wings of carriage, using the board as a lever to raise chuck in alignment with threaded nose.

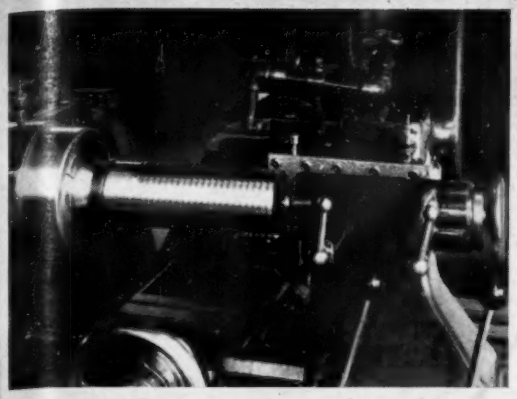
Another good practice is to put a large washer made of blotting paper between spindle shoulder and chuck plate. This may seem amateurish, but it helps to compensate for sticking threads which is one of the disadvantages of this old type nose.

THE R. K. LeBLOND MACHINE TOOL C

CINCINNATI, OHIO

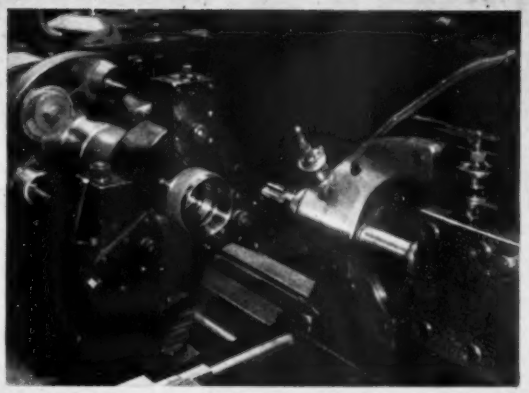
Largest Manufacturer of a Complete Line of Lathes

FOR EXTERNAL OR INTERNAL THREADS



LEFT—Milling a large diameter press brake screw on Lees-Bradner Model H. T. Thread Miller.

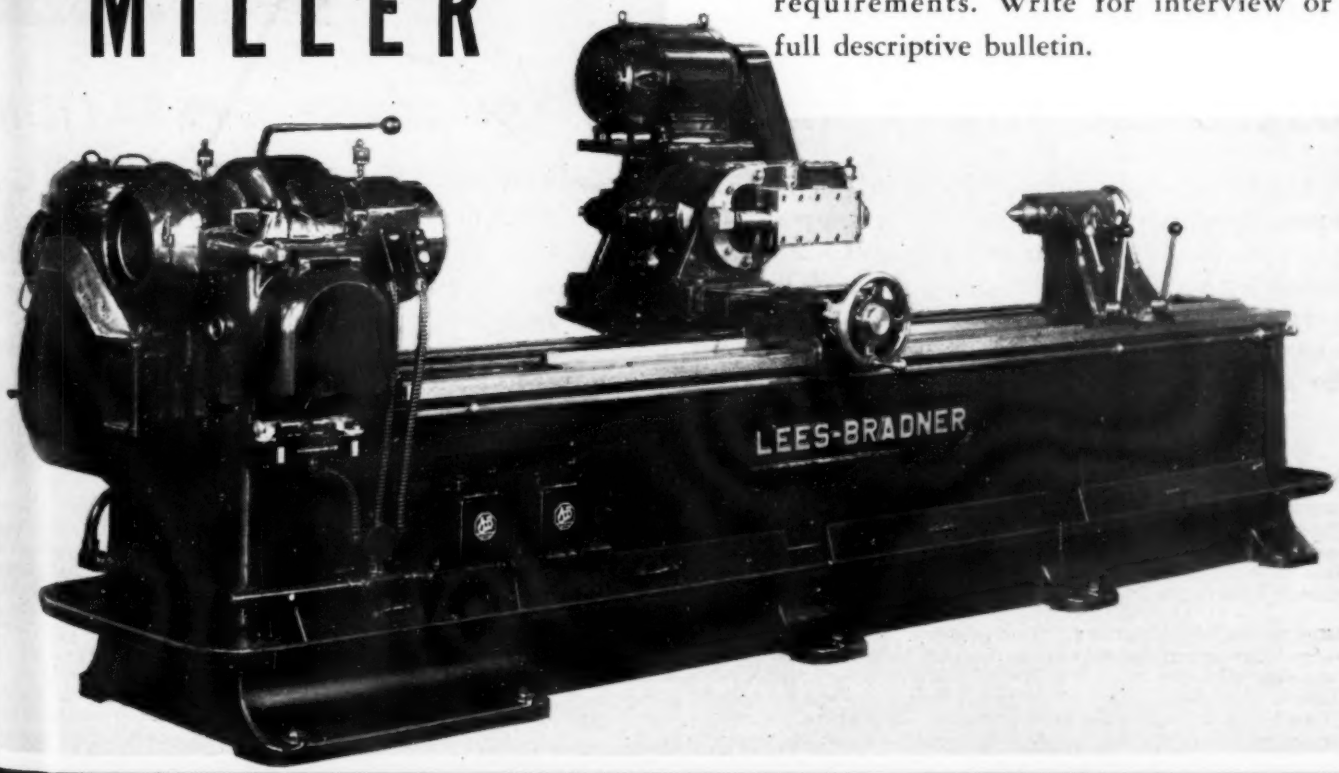
RIGHT—Lees-Bradner Model H. T. Thread Miller arranged with internal attachment milling an internal thread.



with DISC TYPE or RING TYPE CUTTERS

LEES-BRADNER
Heavy Type
THREAD MILLER

● Rigidity is the essence of accuracy in the L-B Heavy Type Thread Miller. Due to this inherent ruggedness speeds and feeds greatly in excess of previous practice are obtained. The result is better threads . . . in less time . . . at lower costs. You need this speed, high productive capacity, and adherence to close tolerances to meet the demands of all out war production. Consult an L-B Engineer on your precision thread milling requirements. Write for interview or full descriptive bulletin.



The LEES-BRADNER Company

CLEVELAND OHIO U S A

Speed WAR PRODUCTION TRAINING

USE THESE BOOKS AND FILMS ON LATHE OPERATION

One of the most serious problems confronting management today is the training of new employees to replace thousands of skilled technicians who have been called for service with the armed forces. With inexperienced workers, production goals must be increased and standards of precision and quality must be maintained. To accomplish this, a vast army of men and women must acquire new skills in the shortest possible time.

To help you train new lathe operators, we offer the practical aids listed below. These books and films on lathe operation have proved effective in hundreds of apprentice training schools, including Army and Navy training stations.

Write for Information on These Practical Training Helps

MOTION PICTURES—"The Lathe" and "Plain Turning"—two new 16 mm sound films in color on lathe operation. Available on a free loan basis for apprentice training. Showing time 20 minutes each. Write for circular.

HOW TO GET THE MOST OUT OF YOUR LATHE—Specialized service bulletins on the care and operation of engine lathes. H-1, "Keep Your Lathe Clean"; H-2, "Oiling the Lathe"; H-3, "Installing and Leveling the Lathe." Sample copies mailed on request.

HOW TO RUN A LATHE—A practical 128 page operator's handbook. 360 illustrations. Written in simple, non-technical style easy for the beginner to understand. Used as a shop text book by the Army, Navy and Air Corps. Price 25c. Sample copy free to apprentice supervisors.

WALL CHARTS—40 different wall charts and blueprints of drill sizes, pitch diameters of screws, standard fit tolerances, correct use of calipers, etc. Ask for Circular BPL listing and describing these charts.

THREAD CUTTING—21 page book, "How to Cut Screw Threads in the Lathe." Shows how to set up a lathe for cutting various pitches of screw threads; setting cutter bits; screw thread formulae; metric threads, etc. Price 10c. Sample copy free to apprentice supervisors.

GRINDING CUTTER BITS—12 page book on grinding lathe tool cutter bits. Covers identification and application of various bits, methods of grinding, correct angles, etc. Price 10c. Sample copy free to apprentice supervisors.

ARMY E NAVY

SOUTH BEND LATHE WORKS

LATHE BUILDERS FOR 36 YEARS — SOUTH BEND, INDIANA

SOUTH BEND TWINS ENGINE LATHES

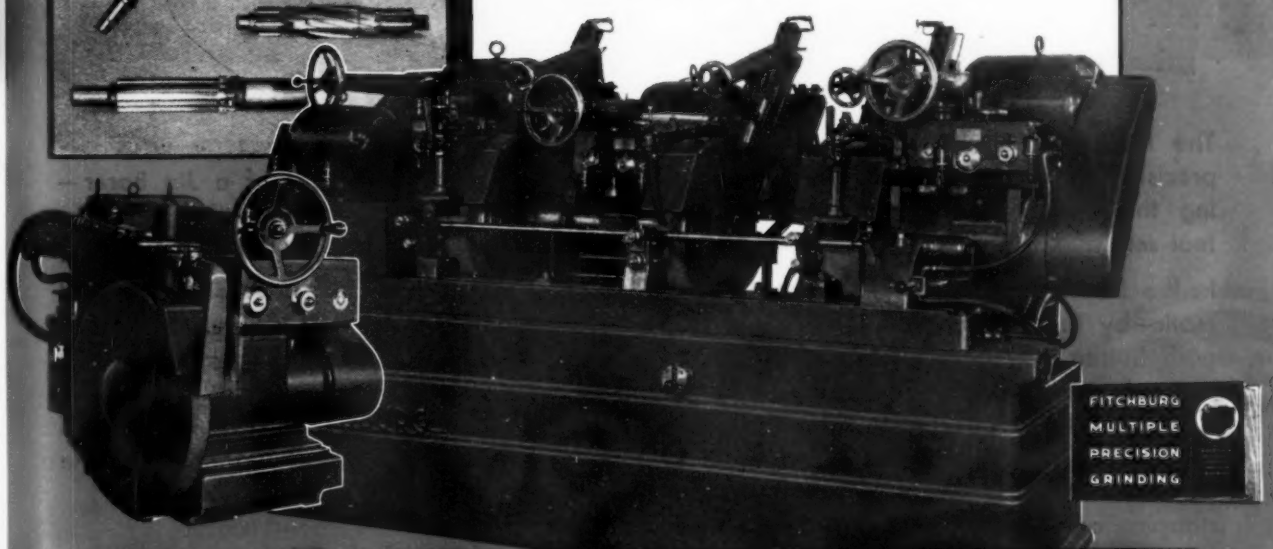
THE FITCHBURG METHOD OFFERS . . . SPECIAL MACHINES FROM STANDARD UNITS

Fitchburg automatic multiple precision grinding offers the same profit possibilities that up-to-date shops now earn with multiple tooling and combined cutting on machined work.

Special machines mounting Standard Bowgage Head Grinding Wheel units, like the one illustrated, enable the precision grinding of two or more dimensions at a single handling. Grinding is completed within the time required for the longest single operation. On mass production work these Fitchburg grinders rapidly repay their cost.

On hundreds of parts like those shown, for machine, automotive or ordinance work, Fitchburg engineers can help you to make sure your orders are filled on time, and at the lowest possible cost. It will not obligate you to mail in your blueprints for study. Catalog shows wide range of other successful applications. Write for a copy today on your business letterhead.

When installing special grinding equipment it is important to remember that the Fitchburg Bowgage Grinding Wheelhead is a self-contained standard unit. It can be remounted on standard machines, or on new special bases, for operations other than the one originally specified. This feature protects your investment.



FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U.S.A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

Retracting and Repositioning Work Within .0002 OF AN INCH—By Push Button

The most frequently needed function in a precision boring machine is that of retracting the work to facilitate measuring and tool setting.

In the DeVlieg Jigmil, this function is automatic—by fingertip control. Operation of a push button unlocks the table and moves it by rapid traverse to the desired position for measuring. For repositioning, operation of a single push button will cause the table to return to its cutting position by rapid traverse, stopping and locking automatically. Uniformity of selected position for stopping and locking is dependable within .0002".

The DeVlieg Jigmil is a new type machine—has the spacing accuracy of a Jig Borer—Performance Qualities of a Milling Machine—Convenience and Flexibility of a Horizontal Boring Mill. All control is so centered and organized that the operator never has to take his eyes off the work.

Thus, the Jigmil fulfills the machine tool ideal—a powerful and accurate extension of the operator's hand.

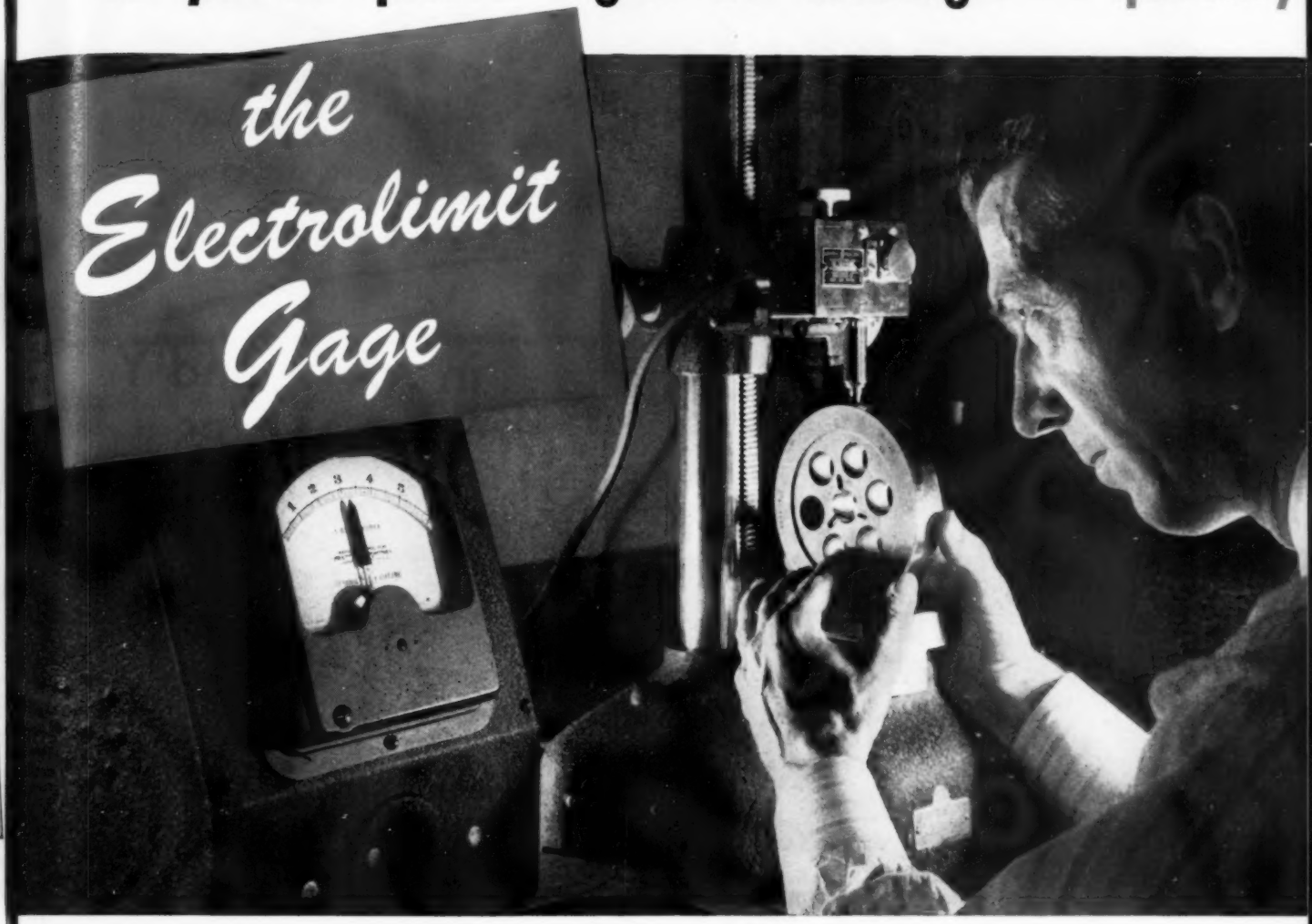
Many machines show 75 per cent greater average daily productivity.

DE VLIEG MACHINE COMPANY
450 FAIR AVE. FERNDALE (DETROIT) MICHIGAN

Write for Circular

DEVLIEG MACHINE TOOLS

To *prove* parts right or wrong . . . quickly



HE IS using a master disk to set his gage . . . a matter of only a minute or two . . . and he'll be ready to check parts precisely to "tenths." Pieces will flow through inspection *rapidly*, with a minimum of eyestrain or fatigue . . . with *no* "operator variation," *no* element of human error. Frequently women do it better than men.

For this is a P&W Electrolimit Gage — one of many Pratt & Whitney products that provide *basic accuracy for mass production*. By mechanical-electrical magnification, this type of P&W gage may enlarge an error as much as 20,000 times. In various forms, it checks internally or externally, one dimension or several simultaneously. In one of its forms, it grades parts in increments of .0005" for selective assembly. It is unusually versatile . . . will serve its owner well in war or peace.

If you need basic accuracy for mass production, call on Pratt & Whitney. There is no better paying investment than the right tools for each job. Details of P&W Electrolimit Gages will be supplied on request.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

Van Keuren

TAPER INSERT PLUG GAGES

. . . in XX, X and Y TOLERANCES . .

PROMPT DELIVERY

. . . Van Keuren: one of the few plants in the United States producing CLASS XX TOLERANCE GAGES . . .

For prompt delivery on plain cylindrical plug gages up to 1.510″ diameter, mail or wire orders to Van Keuren. Large stocks of alloy tool steel blanks and steel handles are available for rapid processing upon receipt of exact specifications. The Van Keuren Co. is one of the few plants in the United States equipped to manufacture Class XX tolerance gages; the experience of over twenty years of gage making and the last word in modern heat-treating, grinding and lapping equipment are combined in this plant to produce fine gages in the shortest possible time. For prices on Class XX, X, Y, or Van Keuren Class "B" (total tolerance .00005″) gages write for catalog No. 31.

Consult the Van Keuren Catalog for Detailed Specifications

"ULTIMATE ACCURACY"

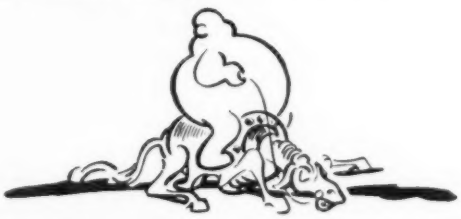
THE Van Keuren COMPANY 176 WALTHAM ST., WATERTOWN, MASS.

Light Wave Equipment · Light Wave Micrometers · Gage Blocks · Taper Insert Plug Gages · Wire Type Plug Gages · Measuring Wires · Thread Measuring Wires · Gear Measuring System · Shop Triangles

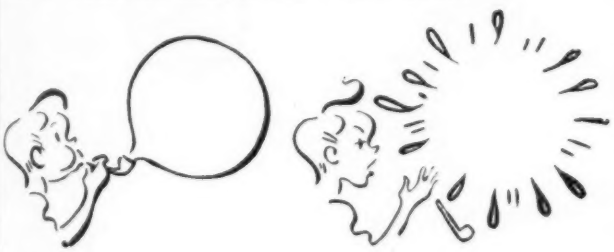
Neglect a Motor AND YOU Sabotage a Motor!

WHOSE MOTORS LAST LONGEST MAY HAVE A LOT TO DO WITH WHO WINS THIS WAR!

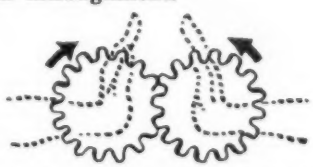
AS ONE of the world's leading builders of electric motors, Allis-Chalmers takes its hat off to the men of maintenance who are working day and night to keep America's motors *rolling!*



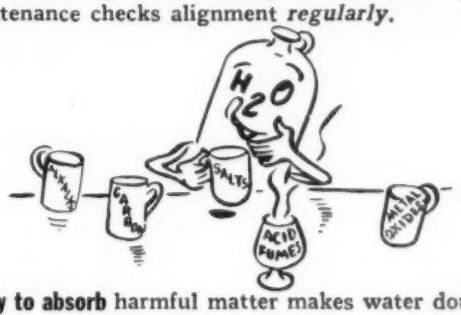
Like an overloaded horse, a motor worked too far beyond its horsepower capacity is sure to break down. So while maintenance men know that we've got to get maximum protection out of every motor to win this production war ... they also know that a close eye must be kept on every motor's overload protection. New fuses and heater coils are a whole lot cheaper than new motors!



The oil film protecting a motor's bearings often is no thicker than the wall of a soap bubble. And if pressure on it becomes too great, the film can fail just as suddenly and *completely!* To protect bearings, maintenance must first protect the *oil film* ... by guarding against excessive pressures from misalignment.



Spur gears constantly try to push apart, foundations are apt to settle, floor loading can be too heavy ... all threatening to disturb alignment. Misalignment sometimes gives a warning before causing damage. But to play safe, maintenance checks alignment *regularly.*



Ability to absorb harmful matter makes water doubly dangerous. Evaporated moisture is pure water when it first condenses in a motor — isn't yet an active destructive agent. That's the time to get it out — *fast!*

Dust fights lubrication. Once inside bearings, it can be as harmful as sandpaper to highly polished surfaces. To keep dust out, oil filler caps must be kept closed — dust seals and gaskets replaced when worn.

Is Allis-Chalmers' new maintenance handbook helping maintenance do its big new wartime job in *your* plant? It's the latest and last word on the subject, easily understood, abundantly illustrated (with dozens of sketches such as above). Send in today for *your* free copy to ALLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.

A 1554

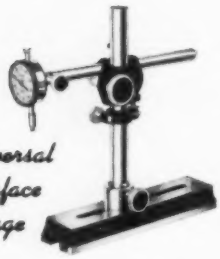
ALLIS-CHALMERS

WE WORK FOR VICTORY — WE PLAN FOR PEACE

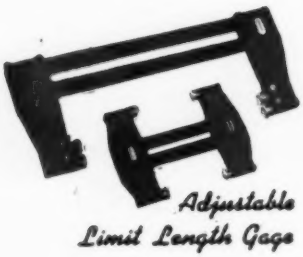
STANDARD Gages

Dial Bore Gage

Snap Gage



Universal Surface Gage

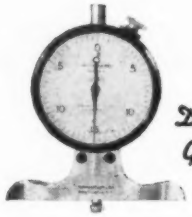


Adjustable Limit Length Gage

Test Indicator

Adjustable Limit Plug Gage

Cylindrical Ring Gage



Depth Gage

Dial Pin Gage

Master Disc

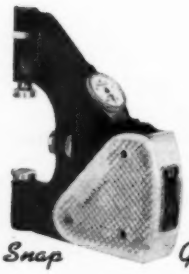
Special Gage

Adjustable Limit Pin Gage

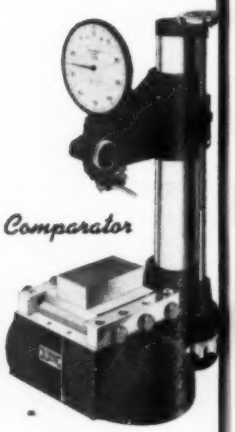
Dial Indicator

Cylindrical Plug Gage

Dial Plug Gage



Dial Snap Gage



Comparator

STANDARD GAGE CO., INC. —— POUGHKEEPSIE, N. Y.

Care For Your Hobs–So Their Life May Be Long!

HERE are suggestions for using hobs that will help to conserve their value and obtain maximum cutting life:

1. SHIFT OFTEN. As the hob approaches dullness, shift lengthwise to a new position. Use as many positions as possible for each sharpening, and shift from each position soon enough to prevent excessive wear.

2. SHARPEN OFTEN. Do not allow hob to become excessively dull. By sharpening often, before wear becomes serious, only minimum stock removal will be required.

The less stock removed at each sharpening, the longer will be the hob life.

3. USE PROPERLY. Select feed and speed which do not overload the hob beyond its strength. Do not jam hob into the work with rapid traverse. Select a proper cutting oil for the job which will carry away maximum heat. Keep coolant supply clean.

4. STORE CAREFULLY. Sharp cutting edges will nick or chip if allowed to bang against other hardened cutters. Use the special boxes in which B-C Hobs are shipped, for proper protection in storage. Experienced users of hobs, as a rule, know these precautions well and have observed them for years. But, in war work, less-experienced operators are handling hobs and hobbing machines. It is up to everyone to see that carelessness in the use of hobs does not create a needless waste.

THE PICTURES...

Top, Left. A special B-C spline hob. Used to hob lock nut for aircraft engine starter. Hob gave 4 positions with .010" stock removed per sharpening, for a total of 36 sharpenings.

Bottom, Right. A double-thread, 16-21 pitch B-C roughing hob. Used to hob aircraft engine starter gear shown. Hob gave 4 positions with .010" stock removed per sharpening, for a total of 22 sharpenings. Hob speed, 133 r.p.m.; feed, 0.012" per revolution of work.

Buy WAR SAVINGS Bonds

CONSERVE CUTTING TOOLS FOR VICTORY

B-C
COLMAN
HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

Barber-Colman Company

GENERAL OFFICES AND PLANT • 201 LOOMIS STREET • ROCKFORD, ILLINOIS, U. S. A.

REINFORCEMENTS

Top quality cutting tools are effectively reinforcing the production drive of industry's machine tool divisions.

MORSE THERE IS A DIFFERENCE **TWIST DRILL AND MACHINE COMPANY**
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. - - - - CHICAGO STORE: 570 WEST RANDOLPH ST.

SPEED PRODUCTION and they'll get the *Ammunition*

Threading and Forming Tool Holder. Right hand offset — for fine or coarse threading — no tool marks — more pieces per grind

Threading Tool Holder — Straight and right hand offset — threads close to shoulder — no fitting to gauge when grinding —

Awarded to Auto-Ordnance Corporation for excellence in production of "Tommy Guns".

TRADE MARK Thompson REG. U.S. PAT. OFF.

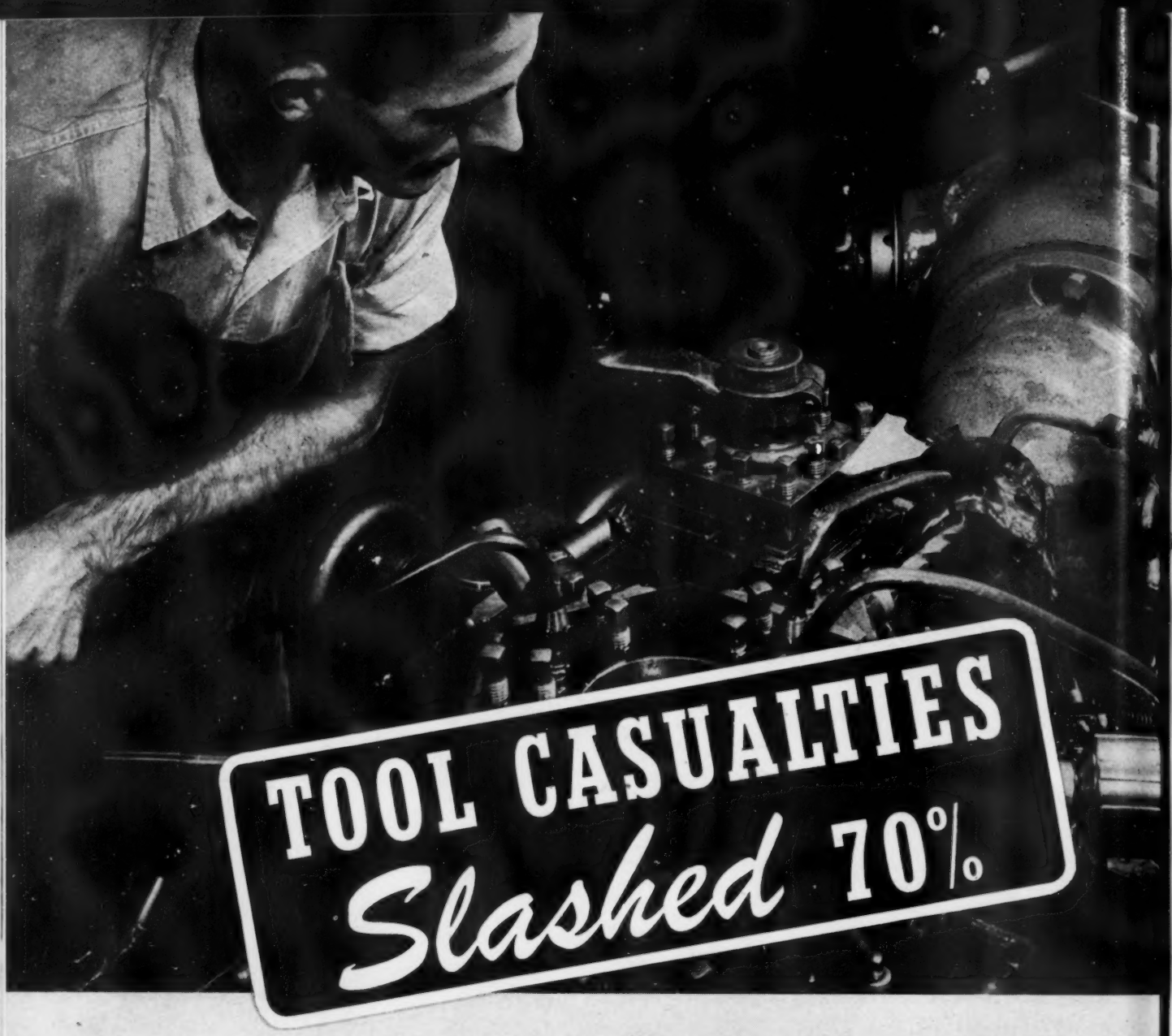
Speed Production and they'll get the ammunition — faster — if Willard Spring Tool Holders are used. Designed specially to speed up production, the "Willard" is accurate, efficient and economical — more pieces per grind — fewer rejects.

Blast the Axis — specify "Willard" and our boys will get the ammunition.

AUTO-ORDNANCE *Corporation*

THOMPSON TOOL DIVISION

342 WEST PUTNAM AVENUE, GREENWICH, CONN.



SUNICUT

"Increases tool life . . . saves time and labor"

Production of vital parts for tanks, tractors and "blitz buggies" was hampered at this large automotive parts plant by poor tool life. Scarcity of small tools added to the seriousness of the problem.

Then a Doctor of Industry—a Sun Cutting Oil Engineer skilled in metal working problems—was called. He studied the conditions and prescribed a change in cutting oil—to Sunicut, the transparent, sulphurized cutting oil. Sunicut proved to be the right answer. The life of valuable small tools was prolonged by 70% . . . fewer "down times" for tool changes were required . . . production was speeded along the line.

War plants of all kinds—with a variety of cutting oil problems—are finding Sunicut's superior metal-wetting and heat-absorbing properties the answer to their metal working problem. Call in a Sun Doctor of Industry today to study your particular operating conditions . . . and recommend the correct grade of Sunicut to increase tool life and boost production in your plant. Write

SUN OIL COMPANY · *Philadelphia*
Sun Oil Company, Ltd., Canada

SUNOCO

SUN PETROLEUM PRODUCTS *HELPING INDUSTRY HELP AME*

CINCINNATI BICKFORD FIGHTS FOR VICTORY

. . . this battery of
SUPER SERVICE RADIALS
is speeding Warner & Swasey
Turret Lathe Production!

• It takes machine tools to make machine tools . . . and here in the plant of Warner & Swasey, it's a battery of Cincinnati Bickford Super Service Radials helping to turn out W & S Turret Lathes in an ever increasing stream. To bring defense production to a peak, Warner & Swasey is working 24 hours a day, 7 days a week . . . and these Super Service Radials **are on the job all the time, and doing a job all the time!**

On this particular unit, the job consists of drilling, reaming and finish boring of a W & S multiple turning head casting . . . the hole is 2½" in diameter . . . four holes are completed, plus a chamfer operation, before the piece leaves this machine.

ARMY (E) NAVY
AWARDED SEPT 10, 1942

Write for detailed information about our complete line of Super Service Upright or Radial metal drilling machines.

SUPER SERVICE

THE CINCINNATI BICKFORD TOOL CO.

OAKLEY · CINCINNATI · OHIO · U. S. A.

There's Nothing New in Women Running Turret Lathes

Machine Accuracy Compensates for Inexperience

A QUARTER of a century ago, during the first world war, many women took the places of men at turret lathes. Then, Warner & Swasey employed scores of women as turret lathe operators. In England, thousands of women have worked at machine tools since the start of the war. Now, in America, as more and more men are called into armed services, women are again taking their places in the ranks of machine tool operators.

Under supervision and with aid in chucking heavy parts, women are fully capable of producing good work on Warner & Swasey Turret Lathes. *The extra capacity and greater accuracy built into modern Warner & Swaseys compensate to a large extent for inexperience and lack of finished mechanical skill.* Controls are conveniently located and much of the turning job is automatic.

Women can not be expected to fill the shoes of expert machinists, but for the repetitive operations required to produce vital war production, women can be trained quickly to operate Warner & Swaseys with surprising speed and precision.

WARNER & SWASEY FOR VICTORY

YOU CAN TURN IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY

WHAT'S IN THIS ISSUE

Readers of AMERICAN MACHINIST will observe that the "trim size" of the current issue of the magazine is slightly smaller than that of previous numbers. The reduction in size has been made to enable the publishers to meet an order of the War Production Board limiting the amount of paper that may be used in 1943. Subscribers will note, however, that no change has been made in size of type or in the amount of editorial content per page, but that substantial saving in paper has been effected merely by trimming the margins.

The publishers have adopted the new size as a war measure and as a contribution to the conservation of manpower and transportation facilities in the production and distribution of paper. Service to the reader has not been sacrificed and will be maintained as far as humanly possible in the face of the problems confronting all of us in our united efforts to win the war.

PLASTIC PUNCHES

Necessity fostered another improvement when it lead to the development of plastic punches. These punches have been found tough, elastic and possessing great impact strength. Preparing plastic punches for use in double-action hydraulic presses requires 3½ hours, as compared to five days required to prepare punches of other materials. Light, easily handled and simply worked, and being of 100 percent reclaimable material, plastic punches are indeed a valuable addition to the technique of metal working. Page 83.

BOMBERS EN MASSE

Though originally conceived to produce parts, it was soon realized that Ford's Willow Run plant would have such output volume as to supply its own assembly line as well as those of other plane builders. Today it is both a parts plant and a complete aircraft producer. Careful study of the aircraft and automotive industries resulted in a simplification of methods to achieve the highest possible production rate. The Armament Section gives the details. Page 93.

HEIGHT GAGE FOR LAYOUT

Adjustments of the scriber on an improved height gage may be attained by use of gage blocks or of a ruler accompanying the instrument. Heavy section of base and blade holder insure rigidity. The base is so designed, with grooves to provide finger grips, that it may be easily and safely moved. Page 89.

LT.-COL. J. A. STONE

GLASS GAGES

Why can't glass replace steel for ring, plug, snap and other precision gages? That is the question Lt.-Col. J. A. Stone asked himself early last summer when he was head of the Gage Laboratory at Frankford Arsenal. He investigated the possibilities, and finding that glass had so many advantages over steel, he immediately experimented with glass gages for inspecting ordnance materiel. Since then many of the gages have been placed in service. Now, as Executive Officer of Frankford Arsenal, Colonel Stone reveals the progress made to date in designs and applications of glass gages. Page 75.

SAFETY FOR THE INEXPERIENCED

Westinghouse Electric & Manufacturing Company's Ordnance Plant at Canton, Ohio, has applied a learn-by-teaching system to the problem of instilling safety consciousness in the minds of new workers. Older trainees are encouraged to teach safety rules to the newer ones. Each shift has a safety committee which includes some of the newest trainees. Results—an outstandingly low accident figure. Page 80.

TIME DATA SHEETS

A study of drilling and handling time on radial drill presses is presented in a series of Time Data Sheets, the first of which appears in this issue. The data were prepared by the Westinghouse Electric & Manufacturing Company. Page 109.

RIVETS BY THE MILLION

It takes some real doing to plate 50,000,000 rivets a day in nickel, cadmium, brass and tin. It requires ace-high equipments set up for continuous production. Herbert Chase tells the story. Page 87.

COMING

Vega Aircraft Corporation breaks its subassemblies down to the simplest shapes. These, as well as special devices and installations used to expedite production will be described in an early issue.

How cage chutes of welded steel rod can be made for moving drawn shells from presses to succeeding operations will be described soon.

MORRIS *Mor-Speed* RADIAL

● Here is a typical example of a Morris Mor-Speed Radial drilling parts in the plants of a prominent truck and bus manufacturer. This radial, like hundreds of other Mor-Speeds, is doing its share towards speeding urgently needed war units to our armed forces. Morris modern construction provides ample strength and increased speed. Rigid base and column design — balanced head and arm construction — all power driven parts running in oil—and a wide selection of feeds and speeds are a few of the Morris Mor-Speed construction features that keep urgently needed War Work flowing 24 hours a day 7 days a week to our many fronts.

Put your next Radial job on a Morris Mor-Speed—for greater production . . . maintained accuracy . . . lower costs.

Pratt & Whitney exclusive Sales Agents for the United States

Builders of MOR-SPEED *Radials*

The MORRIS *Machine Tool Co*

CINCINNATI, OHIO

THIS GAGE CHECKED 150,000 CASES WITHOUT WEAR. PRESUMED LIFE OF A STEEL GAGE IS 50,000 CASES

Frankford Arsenal and ordnance inspectors at many industrial plants now use glass gages. Within certain size limits and revised design considerations, controlled either by glass-making methods or type of service, their performance warrants substitution for steel gages

GLASS FOR PRECISION GAGES

BY LIEUTENANT-COLONEL J. A. STONE, EXECUTIVE OFFICER, FRANKFORD ARSENAL

LARGE-SCALE SUBSTITUTION of glass for steel in the manufacture of precision gages used to inspect war material will soon be an accomplished fact. Although many glass gages are today in service, present and future developments will no doubt result in many changes and improvements over existing designs.

From the inception of the plan, precision gages made of glass have proved feasible. This is not surprising because developments in glassware during the past 20 years has made its use possible in theretofore unheard of applications. To mention but a few: pumps, pipes and fittings in the chemical and food industries to withstand corrosive acids at extremely high temperatures and relatively high pressures; thread guides and rollers in the textile industry; and coil glass springs used safely at fiber stresses of 2,000 lb. per sq. in. And who today is not familiar with kitchen glassware that withstands rough usage and application of heat?

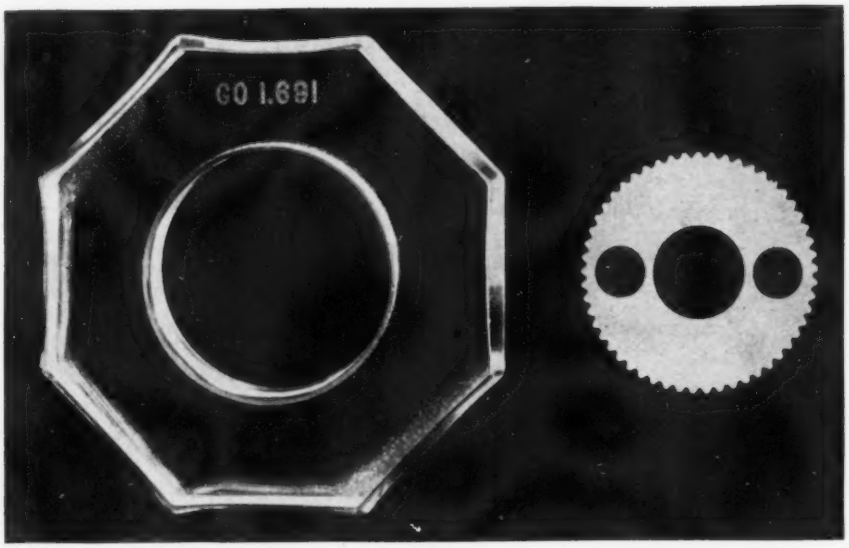
Glass gages have to date demonstrated certain definite advantages over

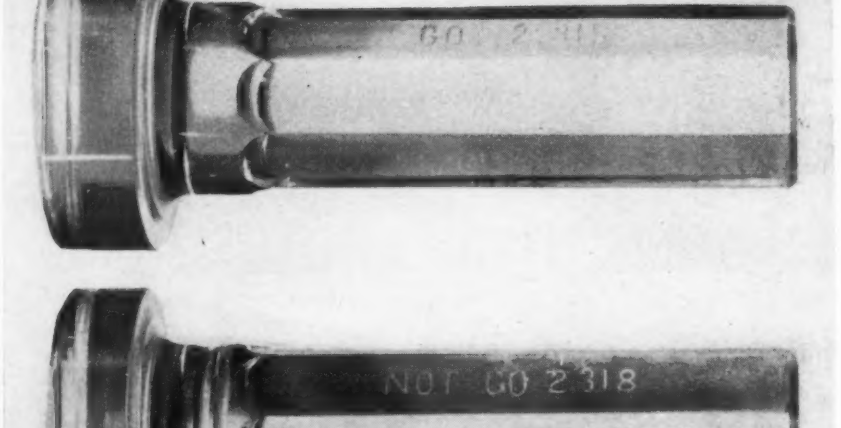
Gages Made From Glass

PLUG GAGES:
Plain "go" and "not go"
Plain, double end

RING GAGES:
Plain, "go" and "not go"
Twin ring
Combination ring and snap

SNAP GAGES (not adjustable)
PROFILE AND POSITION GAGES
FLUSH PIN GAGES (certain types)
CHAMBER GAGES





Glass ring gages at present can be used for inspecting parts from 1/4 to 4 in. diameter. Plug gages of solid glass range from 1/4 to 3 in. diameter. Future developments may increase these ranges. The gages shown here were the first ones designed; many improvments have since been made. Designs currently being specified are shown in the drawings

similar ones made of steel. These are listed in one of the tables. Because of similar advantages, gage laboratory equipment such as surface plates may be made of glass.

Plug gages—At present plug gages of solid glass range between $\frac{3}{8}$-in. and 3-in. diameter, the former being the minimum compatible with mechanical strength. For all these gages under $1\frac{1}{2}$-in. diameter, the handles may be larger than the plug size. Round handles have been used in some cases to date; however, in the future, hexagonal handles only will be specified. Plastic handles are being considered, especially for plug gages up to 1-in. diameter.

Ring Gages—The present feasible sizes for ring gages are between $\frac{1}{4}$ and 4 in. inside diameter; $\frac{5}{8}$ in. is the minimum recommended thickness. As a measure to minimize chipping these gages are to have rounded outside edges and chamfered edges at holes.

Snap Gages—The distance between the faces of snap-gage jaws to date have ranged from $\frac{1}{2}$ to 5 in., while the length of the jaws have been from $\frac{1}{2}$ to $3\frac{1}{2}$ in. Further experimental work is still required before final size ranges are determined.

Profile and Position Gages—The limits on all sizes of profile and position gages are met readily by glass-making and finishing practices. Although the few gages currently in use are made from plate glass, which practice has proved satisfactory and will be continued, there is no doubt that some of the future ones will be molded. Frames made of wood or plastic may be used to protect them from breakage.

Chamber Gages—These gages, used for example in the inspection of shell bodies and cases, have not as yet been made; however, they are under development. Such gages, especially those requiring windows, are expensive to produce when made from steel. When formed from glass tubing by the precision-shrinkage method, quantity lots can be produced at a fraction of the cost of those made of steel.

Thread Gages—At this time, thread gages made of glass are not considered practical.

Flush Pin Gages—Although no flush pin gages have been put in service to date, certain types may readily be made of glass where the minimum size of the pin is held to $\frac{3}{8}$-in. diameter.

Abrasion resistance of glass, reflected in the wear of the gages, is high. For example, in tests made with one ring gage, 200,000 passes of a steel plug resulted in average wear of only 0.000065 in. midway through the hole.

The form of glass gages when originally designed followed practice used for steel gages. However, it has become necessary to change some of the design aspects to minimize chipping, facilitate handling, and limit breakage. For example, the first plug gages of glass were made with edges chamfered similarly to steel gages—design changes now call for a beveled pilot, with less angle than specified for steel ahead of the gaging area to prevent excessive chipping caused by hitting the gage against the sides of holes. Similarly, edges on snap and ring gages made of glass are now beveled and rounded far in excess of those on steel gages. A comparison of the original glass gages and those of recent design, is here illustrated by photographs and drawings, respectively.

Gages produced to date have been made from standard commercial glasses —light flint glass and boro-silicate glass. They are colorless and made from molded or plate stock available in glass manufacturers' plants. However, developments are currently under way to produce glass compositions specifically for precision gages. The best combination of properties, such as hard-

ness, abrasion resistance, coefficient of expansion, thermal conductivity, mechanical strength and chemical stability are being sought. Whether or not the composition or compositions ultimately deemed best suited will be transparent is an open question. Perhaps certain constituents which impart color to the glass may be required in sufficient quantities to make the gages opaque or dark in color. For practically all applications, with the possible exception of chamber gages, this would not be considered a deterrent in the over-all utility of glass for gage service.

A development that can undoubtedly be expected in the near future is the use of color, probably red, to differentiate between "go" and "not go" glass gages. Such coloring is a simple matter in the manufacture of glassware, and for inspectors will be a welcome convenience.

Development of Glass Gages

The developments mentioned and gages described are the result of the initiative and ingenuity of members of the Gage Laboratory at Frankford Arsenal. However, the idea is not original with them. Glass gages have been contemplated before but no knowledge of their previous application in this country is available.

Early last year, when need for tool steel became critical, some consideration was given to the use of glass for precision gages. However, little or nothing was done about it at the time, possibly because the idea was slightly revolutionary. But other considerations presented themselves, all of which proved to be points in favor of using glass instead of steel: (1) Expansion of close-tolerance steel gages by conduction of body heat while held in the hand of inspectors may affect the function of the gage. (2) The careless way in which inspectors handle steel gages —prompted no doubt by an ingrown but faulty conception that steel gages can take all kinds of rough handling. (3) Inspectors are prone to continue using steel gages after being damaged, either by burrs or sprung bodies. (4) Steel priorities and heavy orders for steel gages often delay delivery from manufacturers, thereby retarding production of vital war materials when they are most needed.

In July, 1942, word was received that at least one American manufacturer was experimenting with glass for precision gages. After investigating this instance, the Frankford Arsenal Gage Laboratory ordered a glass gage for experimental purposes. Within two days it was delivered—actual production time was three hours. Incidentally, it was made from an ordinary glass candlestick holder. After grinding, it was checked in the Frankford Arsenal Gage Laboratory for size, roundness and bellmouth by a Pratt & Whitney electrolimit comparator and was found to be within 0.00005 in. of specified dimensions.

Orders were then placed for a number of gages, and within two weeks they were delivered. They proved to be as accurate dimensionally as the experimental gage. Other glass manufacturers were consulted, and work started immediately on specifications to cover gage glass of maximum hardness, abrasive resistance, and dimensional stability. Work in this regard is still under way; however, some of it has been completed, and the results have warranted extended use of glass for precision gages.

It is in such phases of the development of glassware for gages that Frankford Arsenal has taken the lead. This has not been the results of the efforts of one man. The writer is particularly indebted to Lieutenant Franklin Smith and Mr. Benajmin Patton for their assistance in the development of glass gages, and to Colonel John B. Rose, Commanding Officer, Frankford Arsenal; and Colonel Harry B. Hambleton, Colonel D. Allen Lenk and Lieutenant-Colonel William J. Darmody, of the Office of Chief of Ordnance, for their encouragement.

It might be interesting to know that when glass gages are mentioned and discussed, the question of fragility is invariable raised. This is excusable, of course, because of the nature of the material under consideration. However, those who persist in the opinion that glass for precision gages is fragile and easily broken unless handled with extreme care have not been fully aware of developments in the glass-making industry. As a case in point, which was used to dispel such criticism, one glass plug gage was used to drive a nail through a $\frac{3}{4}$-in. pine board. The gage did not break and remained dimensionally unchanged. However, certain precautions have to be taken to prevent breakage—increased section thickness, beveled edges, rounded corners, and framing where possible with wood or plastics. The tops of inspection

The Advantages of Glass Gages

1. In the production of glass gages there is a saving of tool steel.

2. Glass gages afford visibility in inspection.

3. Extended use of glass gages will release for other production machine-hours and man-hours now consumed in annealing, machining, heat-treating and eliminating distortion of steel gages.

4. Glass gages are not subject to corrosion.

5. Since glass gages do not rust, greasings and degreasings necessary for steel gages during shipment and storage are eliminated.

6. Because thermal conductivity of glass is less than steel, body heat of inspectors will not be transmitted so rapidly to the gage to affect gaging dimensions.

7. Scratches and slight chipping on glass neither burr glass gages nor change their gaging functions.

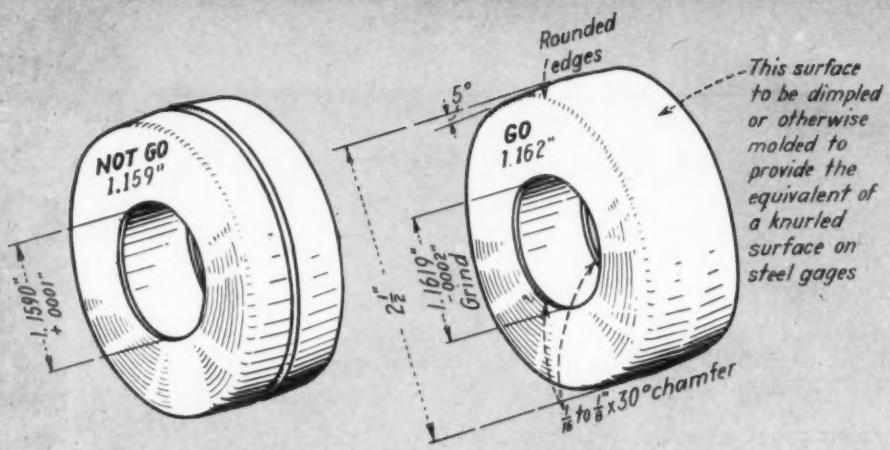
8. Where the part being inspected is very near the size of the gage, there is less tendency for it to sieze or gall on glass than on steel.

9. Sense of feel is more pronounced when using a glass gage.

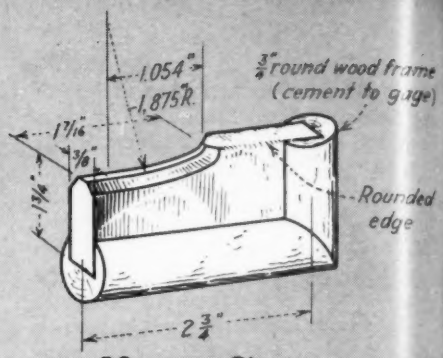
10. The use of glass will teach inspectors to handle gages carefully.

11. Glass appears to have abrasion-resisting qualities better than steel for gaging applications.

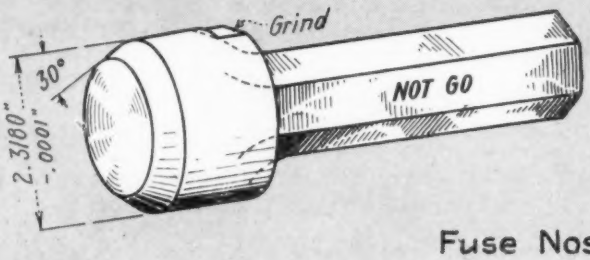
12. When a steel gage is dropped, it may spring or deform, and its gaging functions thereby impaired. A glass gage either breaks or it remains dimensionally unchanged.

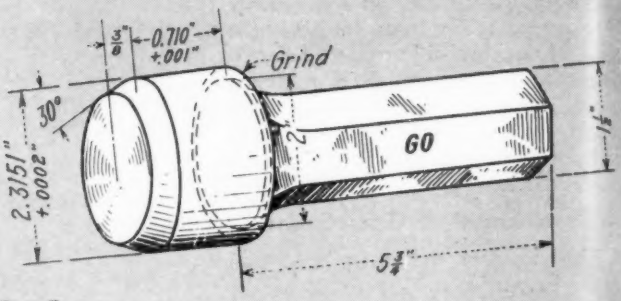


Ring Gage, Fuse Component



20-mm. Shot Ogive Profile Gage





Fuse Nose, I. D. Gages

Glass plug gages now have pilots beveled at 30 deg. These and other gages of glass have beveled edges and rounded corners to prevent chipping. It is important to realize that chipping does not normally affect the functions of glass gages. When glass gages are dropped and do not break, they will remain unchanged dimensionally because they do not spring or deform as a metal gage might if subjected to such handling

benches and adjacent floor areas can be covered with a resilient material, such as wood or linoleum.

Grinding of Glass Gages

Despite the great difference in hardness, toughness and abrasion resistance of so-called "soft" and "hard" glasses, there is relatively little difference in the rates at which glass can be removed by grinding. However, it is necessary to correlate wheel specifications, wheel speed, wheel traverse speeds, and depth of cut with the characteristics of the specific glass composition involved. For example, the hard boro-silicate glasses have great heat-shock resistance because of low expansion coefficient. Also, they have slightly higher thermal conductivity. Consequently, they tolerate grinding at rates sufficiently faster to nearly compensate for the softness and easier grinding of the "soft" glasses. It is possible, however, that the special glass compositions for gages having the higher expansion coefficients necessary to match carbon steel, but incorporating toughness and abrasion resistance to a maximum degree, may have to be ground at somewhat lower speeds than "soft" glasses.

Listed below are specific data on wheels and speeds for grinding glass, as derived mostly from experience with finishing those made from boro-silicates:

Grinding wheels:	
Material	Silicon carbide
Wheel grade	Soft
Bond	Vitrified
Grit size	60, 80, 100, 150
Wheel size	2×½ in. to 14×1½ in.
Grinding recommendations:	
Wheel speed, surface ft. per min.	350–2,400
Depth of cut, in.	0.003–0.005
Work (1 ft. diam.) speed, surface ft. per min.	400
Work (¼" diam.), surface ft. per min.	90
Traverse speed, in. per min.	10–25
Coolant	Soluble oil

In arriving at the best combination of wheels and speeds for fastest grinding care should be exercised to stay under the grinding rate which results in "firing" or "sparking." When firing occurs, it is apt to cause checks or microscopic cracks in the glass, and these have a weakening effect.

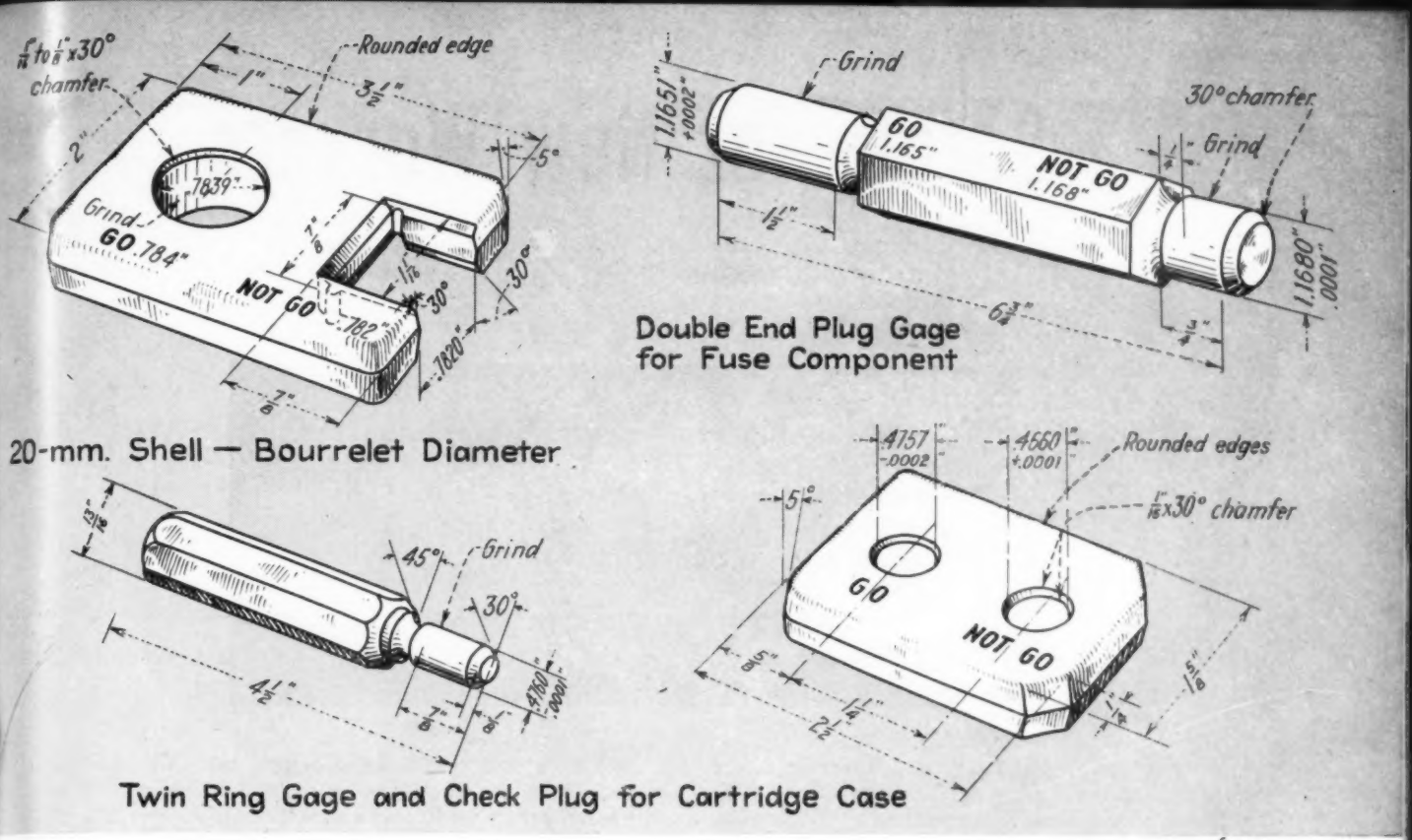
Design of the set-up for holding the glass blank in the grinder should take into account the modulus of elasticity of glass. In general, this is only one-third that of steel, and flexure under load is accordingly three times as great. When chucking plug-gage blanks, for example, the overhang should be reduced to a minimum, even though this might require a narrower wheel than otherwise would be used. Furthermore, clamping stresses should be held to a minimum.

For lapping or polishing to close dimensional limits, rouge is excellent. But in those instances where required tolerances can be obtained by grinding, an excellent surface finish, almost a polish, is readily attained on glass by proper selection of wheels and speed.

Glass products are made by molding, rolling and drawing. It is possible to produce glass for gages by all three methods.

Font Molding—This practice of molding glassware requires the use of open-and-shut molds. These can be made in such a way that there would be inserts forming the end section of double-end or single-end plug gages. The outside diameter of such gages could then be made easily in a whole series of sizes by using inserts of different diameters in the proper molds. Font molding can be used for the production of blanks for ring, plug, snap and profile gages.

Precision-Shrinkage Molding—This process is comprised basically of heating a glass cylinder mounted on a special alloy mandrel. Heat is applied until the glass flows plastically. By application of vacuum or pressure the glass



is forced down onto the mandrel which reproduces its surface finish, contour and dimensions faithfully on the glass. It would be necessary, however, to use glasses of relatively low expansion; otherwise, the metal mandrel could not be removed satisfactorily from the shrunk glass blank upon cooling. Gages can be produced by this method with dimensions so close to finish specifications that only light grinding and lapping would be required. An example of this would be the use of the precision-shrinkage process for making ring gages, wherein variation of inside diameters can be held to better than 0.0001 in.

Glass gages can be strengthened by thermal tempering. By this process, flexural strength is increased along with improvement in impact resistance. This would decrease chipping and breakage considerably.

Some of the characteristics of glass, especially those of particular interest to gage makers and users, warrant mention:

Thermal Conductivity—Glass has a thermal conductivity of 0.333–0.700 Btu, which is the amount of heat that flows in 1 hr. through 1 sq. ft. of plate 1 ft. thick having a temperature difference of 1 deg. F. between its faces. This compares to approximately 26 Btu for steel. The lower thermal conductivity of glass, with the resulting slower transmission of heat as compared to steel, is a natural advantage for glass gages, because expansion resulting from body heat is nil compared to those made of steel.

Coefficient of Expansion—Coefficients of linear expansion of glass ranges from 0.0000018 in. per deg. F. for boro-silicates to 0.0000050 in. for plate and crown glass. This coefficient for steel for gages is approximately 0.0000060. Specifications for the glass ultimately formulated for gage use will have a coefficient of expansion comparable to that of steel; at present it is specified at from 0.0000040 to 0.0000060 in.

Impact Resistance—Because of its low tensile strength, and because glass does not flow when cold, its impact resistance is much less than that of steel. However, by eliminating sharp corners and using large section thicknesses, impact resistance can be greatly improved.

Abrasion Resistance—A rough comparison of the hardness or abrasion resistance of glass is afforded by the Mohs scale of mineral hardness in which quartz is 7, diamond is 10, and glass is from 6 to 7. The boro-silicates, with a high silica content, are among the hardest glasses available commercially. Also, they are "tough," being almost three times as resistant to sandblasting as ordinary window or bottle glass made of soda-lime composition.

Corrosion Resistance—Chemical stability can be incorporated to such a degree in glass that it will withstand indefinitely corrosive action of the most powerful mineral acids, excepting hydrofluoric acid. Consequently, when glass is used for precision gages, corrosion is not a problem as it is with steel gages.

Coefficient of Friction—Because of the hardness, extreme smoothness and non-crystalline structure of polished surfaces found in glassware, it has a low coefficient of friction. This will be reflected in the use of glass for precision gages. They will have less tendency than steel gages to gall in or on parts being inspected.

Weight—The comparative weights of glass and steel are around 160 and 485 lb. per cu. ft. respectively. The lighter weight of glass is obviously an advantage in its use for gages.

Modulus of Elasticity—In general, the average moduli of elasticity of glass and steel are 10,000,000 and 30,000,000 lb. per sq.in., respectively. Therefore, the flexure of glass under load is three times as great as that of steel. This has no effect upon glass gages in service; however, it does have an effect on the handling of gages during grinding and lapping. For instance, in grinding plug gages, the over-hang from the chuck must be held to a minimum to avoid excessive deflection and breakage from high bending loads induced by side pressure of the grinding wheel.

The technical data on glass making and finishing in this article, as well as the characteristics and properties of glass, were furnished by Mr. T. J. Thompson, Corning Glass Works.

Safety for New Workers

BY GLENN M. DAUBACH, WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

A plant employing workers with no industrial experience *can* maintain a high safety record. It requires a cooperative safety organization that catches and maintains employees interest

IRON-CLAD RULES and regulations do little to keep down accidents. It takes personal presentation of the problems, constantly applied in a diplomatic way by workers themselves, to make other employees safety conscious.

This philosophy is obtaining outstanding results in one of the new ordnance plants operated by Westinghouse Electric & Manufacturing Company employing thousands of workers who previously had no industrial experience. Today this plant has the best safety record of all Westinghouse units. This took organization—organization that has for its creed: "There is no better way to learn safety than to teach it."

Safety lessons begin as soon as a man is hired. Safety shoes and safety spectacles are fitted on the new men during the employment procedure. Those who wear glasses are urged to obtain safety spectacles ground to prescription. They receive Westinghouse safety instruction booklets for study.

Trainees receive instruction in machine tool operation and other metal-working trades in shops located near the ordnance plant. Three classes are conducted daily on eight-hour shifts. Each shift is so arranged that one-third of the trainees are new employees. The other two-thirds are encouraged to teach safety rules to the new members of their class.

There is a safety committee on each shift, and 10 percent of the newest trainees are placed on it. Each committee holds regular weekly meetings and makes recommendations for eliminating safety hazards. During working hours, each trainee is requested to watch for infractions of safety rules on the part of his neighbor. They make certain that sleeves are rolled up, and that flowing neckties, wrist watches and finger rings are discarded before work is started. As a result of this program, the trainees are filling their places in the new ordnance plant as fully trained in safety as in their specific trades.

Organization Does It

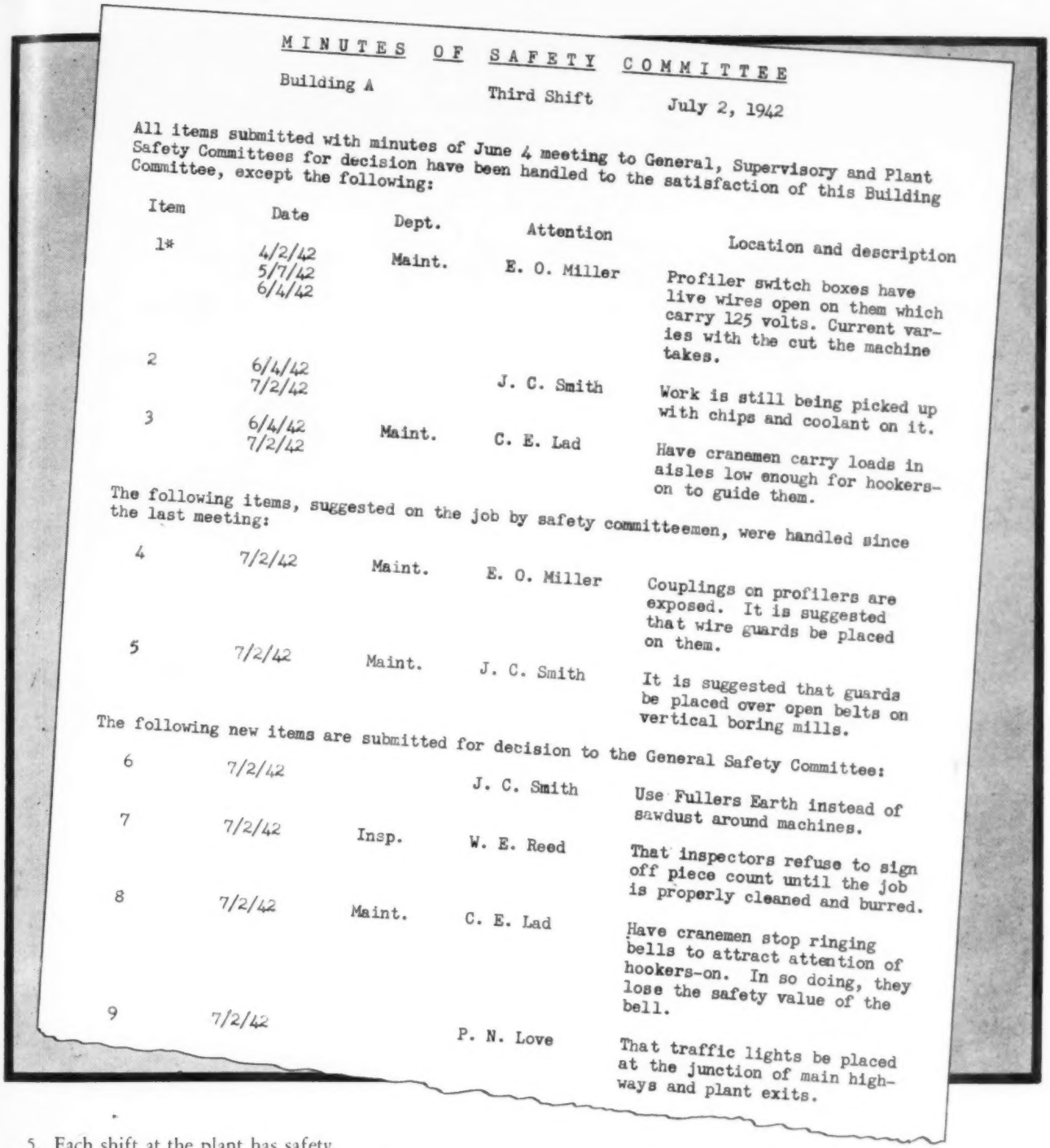
The safety organization at the ordnance plant itself is given full credit for the very low "accident frequency" ratio (number of accidents per million hours worked) of 2.05, during May, 1942, which for this month placed this plant ahead of all other Westinghouse units and eighth in the National Safety Council standing of heavy machine shops. The organization is divided into the following groups:

1. A plant safety committee headed by the plant manager and comprised of his superintendents and supervisors. This group meets monthly and considers safety questions only of plant-wide importance.

2. A supervisory safety committee comprised of superintendents and foremen which holds periodic meetings to settle questions affecting divisions.

3. A general safety committee selected from outstanding safety workers. Two men from each building in the plant are on this committee which inspects the plant monthly and makes recommendations on questions of plant-wide policy. This committee is consulted on all questions that are not or cannot be settled either within a specific department or by the safety committee which functions in each separate building. Members of this committee are appointed by the plant manager for a period of one year. The chairman rotates in monthly meetings of one hour, at which the safety supervisor of the plant acts as secretary.

4. A safety committee in each building consisting of one man from each department of 35 men or less. When there are appreciably more than 35 men in a department, one man for each 35 is selected. Members are chosen from among the electricians, machine operators, inspectors, maintenance men, volunteer firemen, time-study men, "hookers-on" and trainees. Foremen and assistant foremen rotate as chairmen of these committees, each man acting for three months. Each committee makes an inspection of its particular building once a month, and a one-hour meeting is held one or two days thereafter. It prepares safety recommendations, each of which is numbered and dated on a prepared form, and incorporated in the minutes of the meeting. The minutes are presented to the general, supervisory, and plant safety committees, which grant authority to carry out all recommendations other than those which can be handled by department foremen. The minutes are read at the next meeting of the Building Safety Committee, and items not handled by the supervisory groups are kept on succeeding minutes until definite action is taken. This fact is illustrated by the minutes shown in the accompanying table. If a safety recommendation is submitted to a department foreman, and he does not take corrective action, it is reported in the next monthly report to the higher safety committees. If quicker action is necessary, the plant safety supervisor is notified, who then carries on further negotiations.



MINUTES OF SAFETY COMMITTEE

Building A — Third Shift — July 2, 1942

All items submitted with minutes of June 4 meeting to General, Supervisory and Plant Safety Committees for decision have been handled to the satisfaction of this Building Committee, except the following:

Item	Date	Dept.	Attention	Location and description
1*	4/2/42 5/7/42 6/4/42	Maint.	E. O. Miller	Profiler switch boxes have live wires open on them which carry 125 volts. Current varies with the cut the machine takes.
2	6/4/42 7/2/42		J. C. Smith	Work is still being picked up with chips and coolant on it.
3	6/4/42 7/2/42	Maint.	C. E. Lad	Have cranemen carry loads in aisles low enough for hookers-on to guide them.

The following items, suggested on the job by safety committeemen, were handled since the last meeting:

4	7/2/42	Maint.	E. O. Miller	Couplings on profilers are exposed. It is suggested that wire guards be placed on them.
5	7/2/42	Maint.	J. C. Smith	It is suggested that guards be placed over open belts on vertical boring mills.

The following new items are submitted for decision to the General Safety Committee:

6	7/2/42		J. C. Smith	Use Fullers Earth instead of sawdust around machines.
7	7/2/42	Insp.	W. E. Reed	That inspectors refuse to sign off piece count until the job is properly cleaned and burred.
8	7/2/42	Maint.	C. E. Lad	Have cranemen stop ringing bells to attract attention of hookers-on. In so doing, they lose the safety value of the bell.
9	7/2/42		P. N. Love	That traffic lights be placed at the junction of main highways and plant exits.

Safety suggestions approved by the Building Committee and not handled by the General, Supervisory or Plant Committees, re-appear on succeeding minutes until a decision is made concerning them

5. Each shift at the plant has safety committees as outlined in 4.

6. Motor and electric truck drivers on each shift have organized safety committees. They make recommendations regarding traffic regulations and the operation of material-handling facilities of the plant transportation system. Courtesy and carefulness are the watchwords of this group.

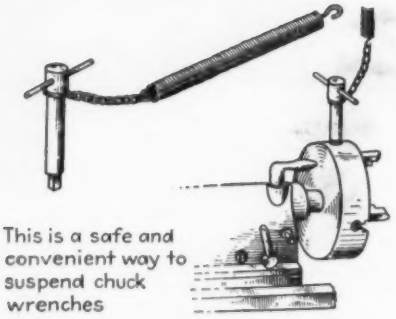
Factors other than these safety committees have contributed to the remarkable safety record at this plant. Safety slogans are painted on signs 14 ft. wide and 7 ft. high so placed near the entrance to plant buildings that employees cannot help but observe them.

Every worker is given a thorough physical examination, not to eliminate prospective employees, but rather to determine accurately what work a man may be able to do safely. Employees in hazardous occupations undergo periodic examination. The practice of reporting all minor injuries is mandatory. To date, 15 percent of all employees have had first-aid training. Safety organization courses, conducted in collaboration with local colleges and leading industrial concerns, are attended by employees of the plant.

The functioning of the safety program at this plant is the responsibility of the workers. Because of the emphasis placed upon it by the management, and the realization by the employees that benefits from the program accrue to themselves, "safety" is taken with more than the usual seriousness—in fact, it is a live and vigorous part of each day's work.

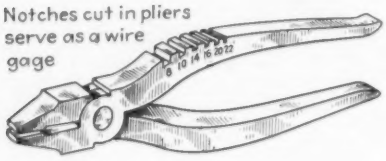
SHORT CUTS FOR THE SMALL SHOP

BY A. H. WAYCHOFF

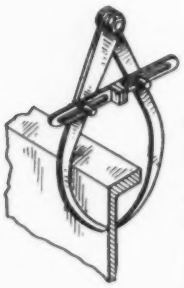


This is a safe and convenient way to suspend chuck wrenches

CHUCK WRENCHES can be made from broken speed wrenches. Cut off the broken sprocket and file flats on the round shank to fit the lathe chuck key sockets. For large chucks, weld to the shank a piece that has been made to fit the key sockets.

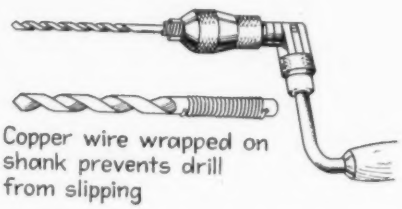


WIRE GAGES are a part of every electrician's and plant engineer's tool kit, but are seldom carried around like a pair of pliers and often are not handy when needed. Notches corresponding to wire sizes can be filed in the thickest part of one handle on wire-cutting pliers, thus making a wire gage that is always accessible. The notches can be made and numbered for the wire sizes used most frequently.



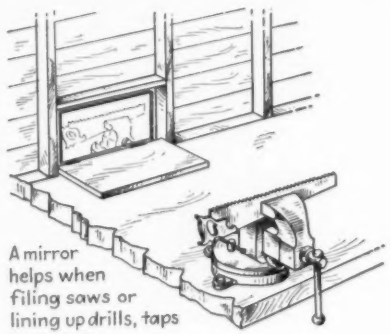
Adjustable stops, held on spring calipers by thumbscrews, can be used to measure the thickness of parts with overhanging projections

SPRING CALIPERS can be altered to measure the thickness of walls with overhanging projections. Drill and tap each leg of the caliper as shown for small thumbscrews to hold two pieces of slotted light scrap iron with one end of each bent at 90 deg. With the calipers set over the over-hanging projection and against the part to be measured, the adjustable stops are set with the angle faces together, and are tightened in that position with the thumbscrews. The calipers may then be opened for removing over the over-hanging projection ,and then closed aganist the set stops. The usual measuring is then done at the point.



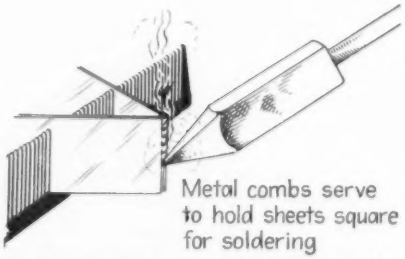
Copper wire wrapped on shank prevents drill from slipping

SMALL DRILLS can be held firmly in braces by wrapping annealed copper wire around the shank. The wire can be annealed by heating and plunging it into cold water. When the chuck jaws are clamped on the wire, the drill may slip for the first few turns of the brace, but after that it will hold firmly.



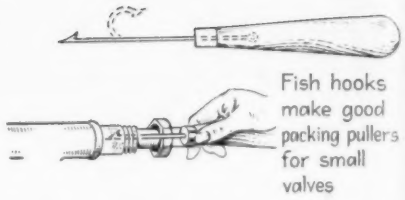
A mirror helps when filing saws or lining up drills, taps and dies

MIRRORS placed at the back of work benches often help to speed such work as filing saws. They also aid in starting taps and dies straight as well as lining up braces and breast, hand, or electric drills vertically or horizontally. The mirror can be fastened against the wall and protected when not in use by a board hinged at the bench surface.



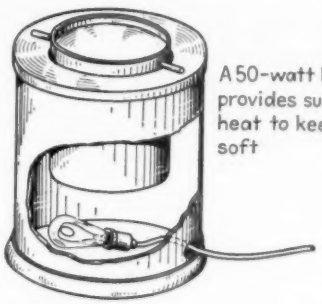
Metal combs serve to hold sheets square for soldering

METAL COMBS make excellent holders when soldering or brazing corners of parts made from sheet metal. This kink may be exceptionally useful for electricians and model makers who often do work of this character.



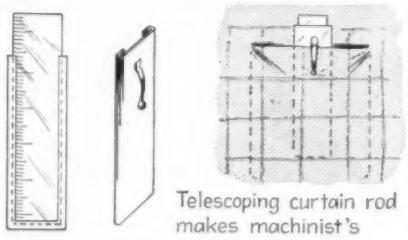
Fish hooks make good packing pullers for small valves

PACKING PULLERS for small valves can be made from fish hooks. Make the handle from a piece of round wood, drilled to receive the hook. A brad driven through the wood and the eye of the hook will keep the assembly intact. After the hook is straightened you have a puller that will remove the tightest packing from the smallest packing glands without prying and damage to the valve stem.



A 50-watt light bulb provides sufficient heat to keep glue soft

WARM GLUE will always be available if the simple device shown here is used. A 50-watt light bulb is inclosed in a ½-gal. can, the top of which has been cut out for a snug fit of the glue pot. The pot is made from a one-pint paint can with a tight fitting cap. A hole drilled horizontally through the pot takes a small rod that holds the glue above the light.



Telescoping curtain rod makes machinist's scale carriers

SCALE CARRIERS with a pencil clip attached prevent small scales from dropping out of machinist's pocket—an inconvenience which always occurs when a mechanic picks something off the floor. Such carriers are easily made from a piece of telescoping curtain rod cut 1-in. shorter than the scale. The pencil clip is soldered to the rod. Pinch the channels of the rod near the bottom so the scale, when pushed down into the channels, will wedge itself.

Power press and drop-hammer punches made of plastic are resilient and spring back under pressure to match the thickness of formed parts

PLASTIC PUNCHES are TOUGH

Used in the forming of aircraft parts, the punches are elastic and have great impact strength. They simplify tooling set-ups and give long production runs

MORE CONSISTENT FORMING of sheet-metal parts and more rapid production of such parts in the drop hammer or hydraulic press can now be accomplished through the use of a plastic punch. Tough, elastic, possessing great impact strength, this thermoplastic is 100 percent reclaimable without sacrifice of physical properties.

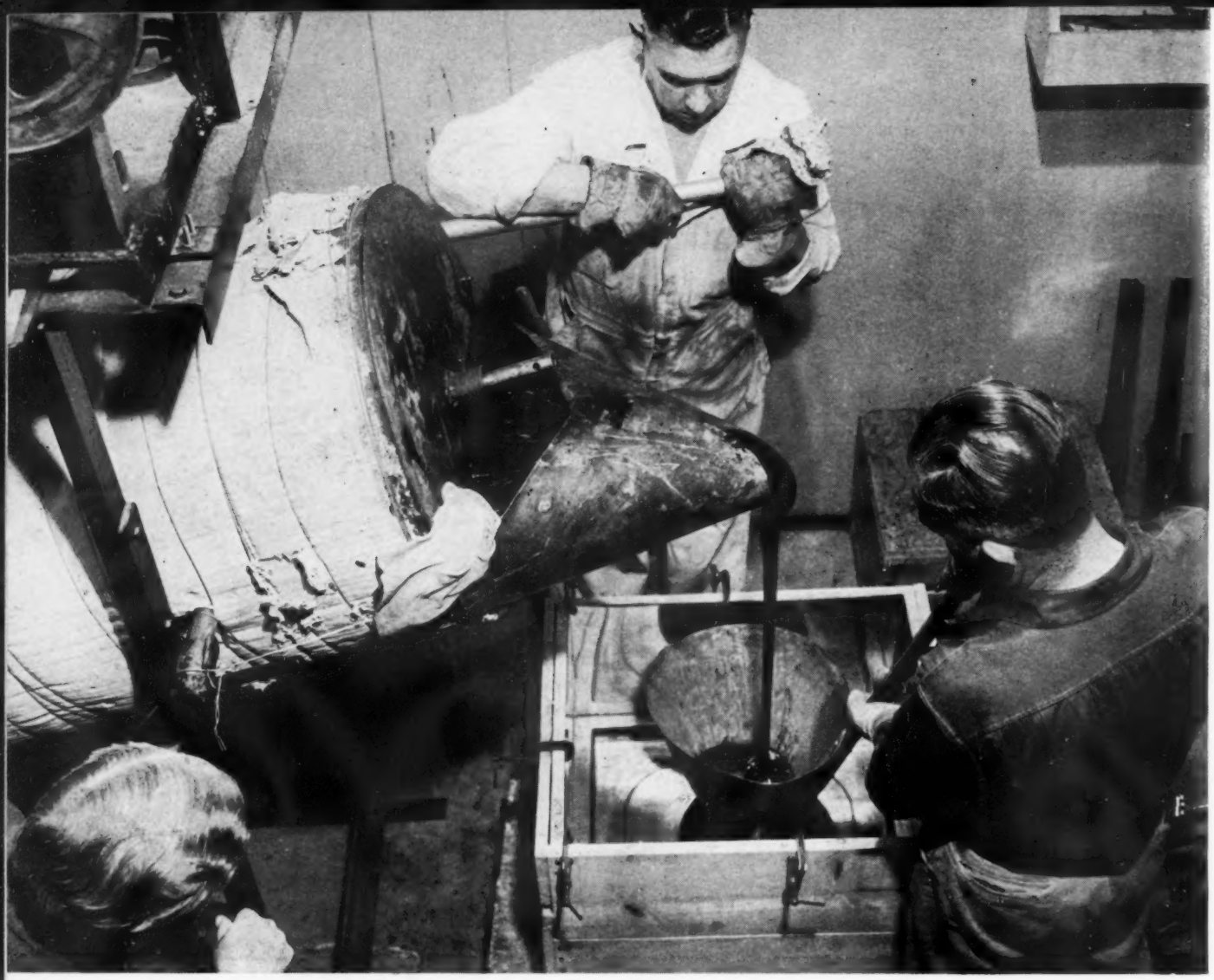
Early in 1942 the Vega Aircraft Corporation, like many industries, was faced with the necessity of conserving critical metals. In an effort to find a desirable substitute for lead and Kirksite punches, a plastic product of the Plastalloy Company of Burbank, Calif., was utilized. First trials were very promising; hence, many further tests followed, formulations being constantly altered to meet the high impact required for such metal forming. Progress has been slow but decidedly encouraging. While some of the problems have not been entirely overcome, the method has reached such a degree of workability that results are here presented to the industry.

A brief review of steps necessary in making and using a lead drop-hammer punch will serve as a basis for judging the advantages of the plastic punch. Lead is cast to the Kirksite die without allowing for metal thickness of the part. Thus, the die must be set up in the hammer and the vertical surfaces scraped in to the die to allow for metal thickness. The drop hammer is obviously out of production during the operation. Further, it is often necessary to re-scrape the punch after a number of parts have been formed because the soft lead punch tends to flatten and spread. Small radii on the punch are likewise beaten back, resulting in larger radii than obtained originally, so that rubber strips must be so placed in the die to form the metal down to the small radii. Since this condition most frequently arises when as few as ten parts have been formed, production on the lot is slowed appreciably. An alternative is to run the whole lot through and then rehit the parts during a second run, using rubber. Either method involves a loss of time which is avoided when a plastic punch is used.

The plastic punch, like lead, is cast directly to the die, without clearance for metal thickness. Beyond this point, the simplicity and economy of the plastic punch method becomes apparent: (1) The punch and die are set up in the drop hammer. (2) Parts are then run.

It is unnecessary to scrape the punch into the die. Being elastic, it simply springs back to accommodate metal

This article was prepared from data compiled by Tool Research Engineering of the Vega Aircraft Corporation, in collaboration with Leon Chapman, chief chemist, Plastalloy Company, Burbank, Calif.



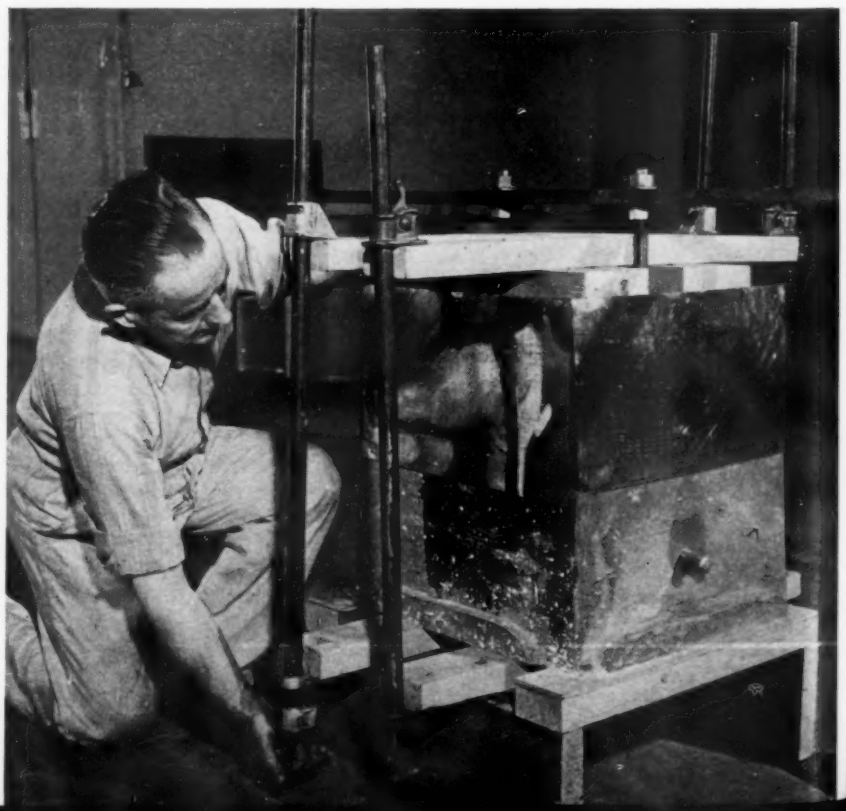
The material is cooked for six hours and mixed constantly with a full-scraper helical agitator. The plastic punch is then poured directly on its die. A funnel, extending beneath the poured surface, is used to prevent the formation of air bubbles and lapping of the material

thickness of the part, recoil accounting for its excellent forming characteristics. The same qualities account for consistent forming of small radii, beads, and the like. It is unnecessary to use rubber strips to form beads. The useful life of a plastic punch has proved many times that of lead. In general, the plastic punch seems to possess the same characteristics as rubber under pressure and, when used in the drop hammer, combines the forming advantages of impact. It most consistently forms the part *true to the die.*

Kirksite Die With Lead Punch:

1. Hit approximately 100 parts one time
2. Anneal
3. Pour new punch
4. Rehit 10 parts

After pouring, a wooden plate and clamps are applied, and the punch is covered with sheet-metal. This causes the plastic to cool from the top down. The pressure forces the plastic into conformity with the die



5. Rehit 90 parts using rubber strips to force out radii—from three to six rehits may be required to produce a satisfactory part.
6. Finished

Kirksite Die With Plastic Punch:

1. One fairly good blow to set
2. Three blows in rapid succession
3. Finished

It is seen that by using a plastic punch an annealing operation and a rehit operation have been avoided. Foundry as well as drop-hammer time is saved since it is unnecessary to pour a second punch.

It should be understood that plastic punches, in their present stage of development, cannot be used on all types of jobs, but those parts which are most adapted to this method of forming may be determined readily. It has been found, for instance, that plastic punches, due to their rubber-like nature, do not iron out wrinkles as readily as lead or Kirksite. But, due to their close fit, fewer wrinkles occur in the first place. This type of punch is less successful, in many cases, in forming stainless steel parts. Often the same part, in aluminum, would form well.

Certain precautions are necessary when setting up the punch in the hammer in order to avoid subsequent cracking of the punch. Threaded inserts located in the punch should line up with holes in the head of the hammer. Otherwise, when the stud bolts which are screwed into the inserts are forced into the hammer, strains are set up in the plastic which are considerably multiplied by impact of the punch in use. Hole locations in the Vega hammers are not uniformly located, but this difficulty has been overcome by using $\frac{7}{8}$-in. studs in the $1\frac{1}{16}$-in. holes; 1-in. studs are normally used in lead punches. Nuts used on these studs must be firmly tight only, not cinched up with tremendous pressure as when using a lead punch. Since most breakage of punches has been found traceable to cracks developing at the metal inserts, these precautions alone have served to reduce such troubles to a minimum. Results are more successful, also, if plastic is warm (around 75 to 100 F.) when set up in the drop hammer.

Hydraulic-Press Punches

Success in the drop-hammer field led to the development of plastic punches for use in the double-action hydraulic press. The long hours of tedious grinding required to fit the punch to the die and allow for metal thickness are avoided because, here again, the plastic punch is poured to the die. A limited amount of clearing of sides or shoulders is sometimes found necessary in order to secure better bottoming as, for example, when beads are to be formed in the bottom of a part. However, if this must be done it can be accomplished while the punch is in the press. In the case of the Kirksite punch and die they are pulled and later set up again for another trial. Thus the plastic punch saves press set-up time. Generally speaking, the punch is merely poured directly to the die and set up in the press ready to go. Due to its elastic nature the punch forms the part true to the die. Normal production difficulties are obviously encountered, but they are solved as any manufacturing problem. For example, it was found difficult to form a number of parallel beads located in the bottom of a certain Vega part. Good beads were obtained by merely increasing pressure. In fact, it was found that enough pressure could be applied to tear the part around the bottom beads.

The following is a comparison of the two methods of making punches:

Kirksite Punch:

1. Make templets
2. Make plaster pattern
3. Cast punch in sand, using mold taken from plaster
4. Grind in punch to fit die, less metal thickness (time: 5 days)
5. Run parts
6. Anneal
7. Hit on drop hammer
8. Rout (trim)

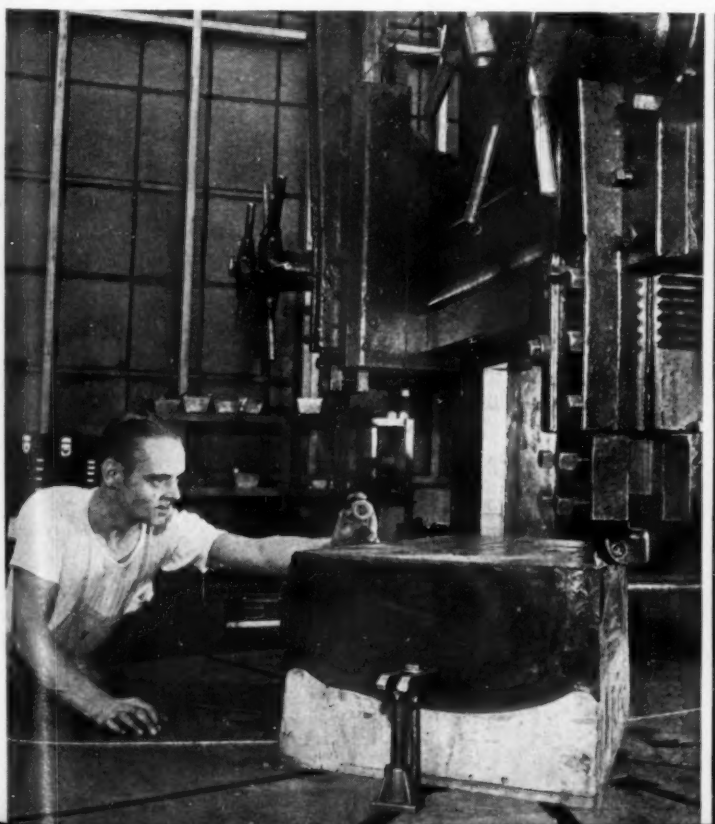
Plastic Punch:

1. Pour directly to die
2. Clear for metal thickness where necessary (time: $3\frac{1}{2}$ hrs.)
3. Rout (trim)

Casting Plastic Punches

Ordinary wood sides are built up around the die and the inside wood

The top surface of the cooled punch *(left)* is machined parallel with the base of the die on a boring mill, planer or hand router. The window frame *(right)* is being formed with plastic punches on drop hammers at The Vega plant. The plastic punch eliminates annealing and rehit operations required for lead dies



Plastic punches save set-up time: Rubber strips (*left*) used with lead dies to form sheet metal down to small radii are unnecessary. Scraping to allow for the thickness of parts being formed (*right*), needed when lead punches are used, is eliminated

surfaces are lined with tin. Fillets are made with molder's clay. Sides usually extend about 10 in. above the top of the die, resulting in a thicker punch than is usual in lead. Experience has shown that impact is better absorbed and transmitted when the plastic punch is about 25 percent greater in thickness than would be a lead punch.

Two distinct Plastalloy materials are supplied and combined to form the final casting compound for punches. This is done to facilitate melting or preparation for casting. For convenience, these materials are termed Plastalloy "A" and Plastalloy "B." The former, which has a low melting point, is first melted to start a batch. When it has reached a liquid state, Plastalloy "B," which has a melting point considerably higher than "A," is added slowly. The mixture is agitated constantly from the start of the "cook" to prevent its burning. Reclaimed pieces may be added while the mixture is being melted. Used or broken punches may be broken up into chunks and remelted as indicated above. To attempt to remelt chunks directly often results in burning them before they have reached a state of fusion; hence, remelt material should be added to a batch of new liquid.

The mixture is heated to and maintained about 45 min. at a temperature of 205° C. (401° F.) at which time the heating agent is cut off and the mix allowed to cool to 175 C. (347 F.), being agitated continuously.

While at this temperature the melt is cast into the Kirksite die, being poured through a special funnel (tin or similar material), the lower end of which is kept below the surface of plastic in the die. Lapping of the material, which tends to cause weakened planes, and trapping of air is so avoided. Immediately after the punch is poured, the inserts, located by means of studs to a spider, are lowered into the punch to a predetermined depth. The top of the insert preferably should not lie more than 2 in. below the surface of the finished punch. Precautions that will insure normal and properly located inserts are: (1) level die; (2) spider parallel to die; (3) accurate spider; (4) holes for studs through the spider to offer a sliding fit and yet hold the studs close to 90 deg. Attention given these details will reduce possibility of breaking the punch in use.

Shrinkage From Top Down

The material is made to shrink from the top of the punch down as it cools. This is done by means of standard cabinet-maker's clamps which apply pressure to a wood plate placed on top of the punch after first covering with metal. The material is thereby prevented from shrinking away from the die and is forced into it.

Cooling requires considerable time depending upon the size of the casting, so that the total time required to prepare, case, and cool a plastic punch is more than that required for one of lead. However, when operations permit having a pot of plastic continuously ready to cast, as is done with lead, the over-all time will be reduced about one-half, for it requires around six hours to cook up a batch.

The top surface of the cooled punch is not ordinarily smooth nor parallel to the base of the die. Therefore the punch is left in place in the die, after forms and clamps have been removed, and the top surface is machined parallel with the base of the die. This is done on a planer or boring mill, although the operation might as easily be done by using a hand router.

The plastic may be cut or worked with any kind of cutting tool. It is not abrasive and does not dull tools. Being a thermoplastic, it cannot be ground or sanded, and tends to gum up tools that generate heat rapidly, such as circular and band saws. However, it may be drilled, tapped, planed, or worked with hand woodworking tools. Further, it is easy to handle for it weighs but 68 lb. per cu.ft.

Experiments are now under way at Vega which, if successful, will make it possible to cast a die from a plaster pattern and cast a plastic punch into this die ready to put into work of a press, all with no machining.

50,000,000 PLATED RIVETS A DAY

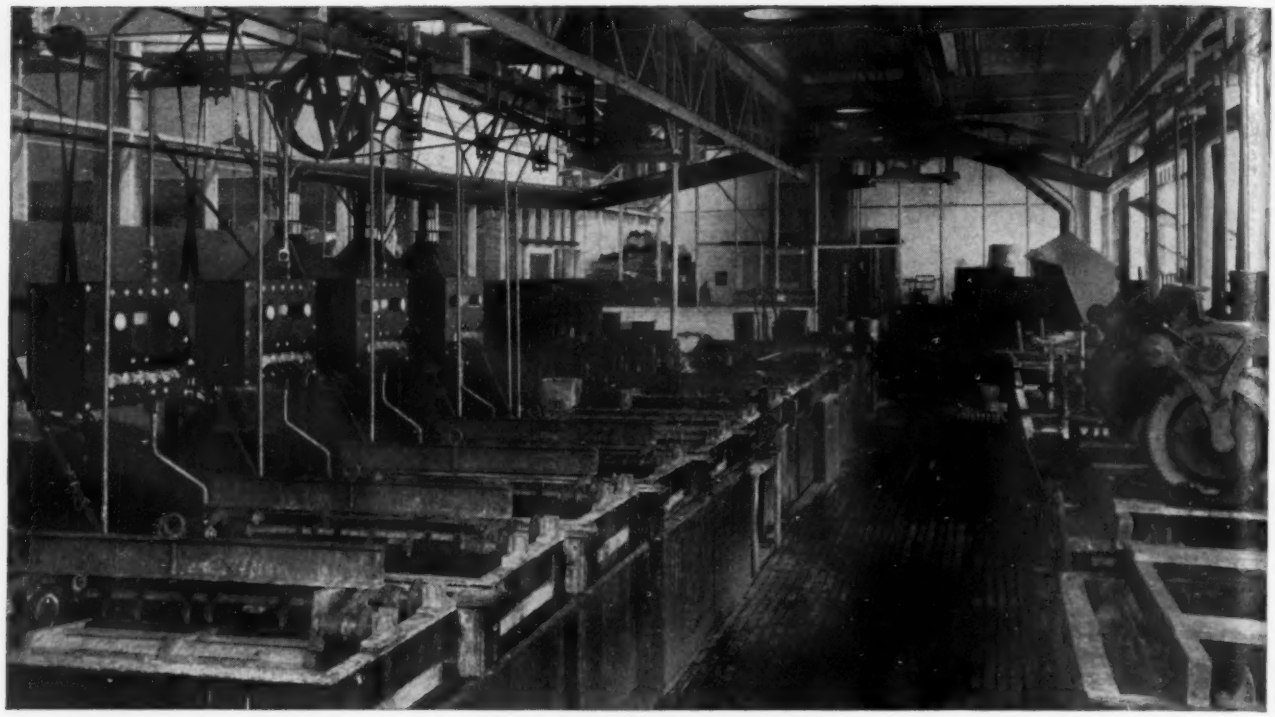
BY HERBERT CHASE

Special handling and cleaning equipment speeds production in this plant. Plating barrels of laminated phenolic and transite sheet are set in the tanks and driven by individual motors. Each tank has its own controls

Rivets are cleaned and burnished in tumbling barrels filled with sawdust. After tumbling, rotation is reversed and the rivets are fed automatically into shaker trays that remove and reclaim the sawdust

PLATING AND POLISHING facilities of the new Chicago Rivet & Machine Company plant are so designed and arranged that production reaches 50,000,000 rivets a day. Two rows of steel plating tanks are located in a spacious bay spanned by a 500-lb. crane equipped with an electric hoist. The floor is vitreous brick that slopes steeply to large drains. In the aisles above the brick, slat flooring rests flush with the bottom of the plating tanks which are elevated on blocks. Ventilation is assisted by a powerful exhaust system arranged to maintain a clear working area for the crane. Each plating tank has its own controls, power lines for which drop to the panel boards from overhead busbars. The latter are fed from a generator that delivers 1,500 amperes at 12 volts, and 3,000 amperes at 6 volts.

Eight of the tanks are equipped for barrel plating—those in which rivets are nickel plated are lined with rubber. The plating barrels, 30 in. long and made of laminated phenolic or transite



A working area clear of shafting, power lines and ventilating ducts allows plating routines to progress smoothly.

Beneath the slat flooring, set flush with the bottom of the tanks, a vitreous brick floor slopes steeply to drains

sheet, will handle loads up to 125 lb. Busbars run around the sides and ends of the tanks, furnishing power to the motors driving the barrels.

Two tanks employing ball anodes are used for cadmium plating. This is done in 45 min. at 10 volts with a current density of 225 amperes per sq.ft. Two tanks are available for copper plating; one at room temperature with cyanide solution, and one at 160 F. with heat supplied by steam coils in the tank. The current in the cold tank is usually 175 amperes for 45 min., and in the hot, 225 amperes for 30 min.—both tanks are operated at 10 volts from rolled-bar anodes. Tin is plated in a single tank for 40 min. at 165 F. with an 11-volt potential and 200 ampere current.

Several tanks are used for nickel plating. This is done in the conventional nickel-salt solution at 120 F The potential is 9 volts, the current is 100 amperes, and the plating time is 115 min. Satisfactory plating of the inside of tubular rivets is assured by keeping the boric acid content up to standard and by cleaning the rivets thoroughly before plating. Rivets to be nickel plated are burnished in a soap solution in an open barrel. This is followed by a two minute anodic cleaning in a caustic cleaner, a cold rinse, a short dip in 50 percent solution of muriatic acid and a final cold rinse. This same treatment is given rivets before cadmium plating with the addition of a cyanide dip before burnishing.

When rivets are cleaned and a plating tank is not available they are stored under water to avoid oxidation by contact with air. There are separate cold-water rinsing tanks for rivets plated with copper, nickel and tin, respectively; each tank is used for rinsing one and only type of rivet. One tank is devoted entirely to cyanide cleaning of rivets which have been annealed after forming. Rivets for brass plating are first cleaned electrolytically for two minutes in a tank filled with a soap solution; the work is alternately the cathode and the anode.

Plated rivets are rinsed in water and dumped into a hopper rack which delivers them into baskets for transfer to an adjacent department where they are burnished in special tumblers filled with sawdust. Each barrel is loaded with 50,000 rivets and rotated for 10 min. at a speed higher than that customarily used in tumbling practice. Coarse and fine sawdust is employed for large and small rivets, respectively. On completion of tumbling, the barrels are rotated in the opposite direction. This feeds the rivets slowly into shaker trays from which they ultimately feed automatically into containers at about floor level. The sawdust is sifted out on the trays and falls into pans from where it is collected for re-use.

Molly Pitcher Fights Again!

Though no longer loading and firing a cannon at her fallen husband's side, Molly Pitcher is in this war beside her man, playing a part as vital as in the Revolutionary Battle at Monmouth.

It was Mary Ludwig Hays—dubbed Molly "Pitcher" by the grateful, and thirsty, American patriots—who carried water to her husband's gun crew until she saw him killed, then stepped into his place and kept his gun firing through the rest of the battle.

Realizing the close parallel between her heroic acts and the work of present day women who have taken work production jobs as their husbands, sons or brothers marched off to war, women war workers at Hyatt Bearing Division of General Motors have organized the "Molly Pitcher" Brigade. They are inviting other plants to join them in similar units to make contributions to men in the armed services, to maintain high standards of efficient workmanship, and to aid in the organization of social and athletic clubs.

Height Gage for Layout Operations

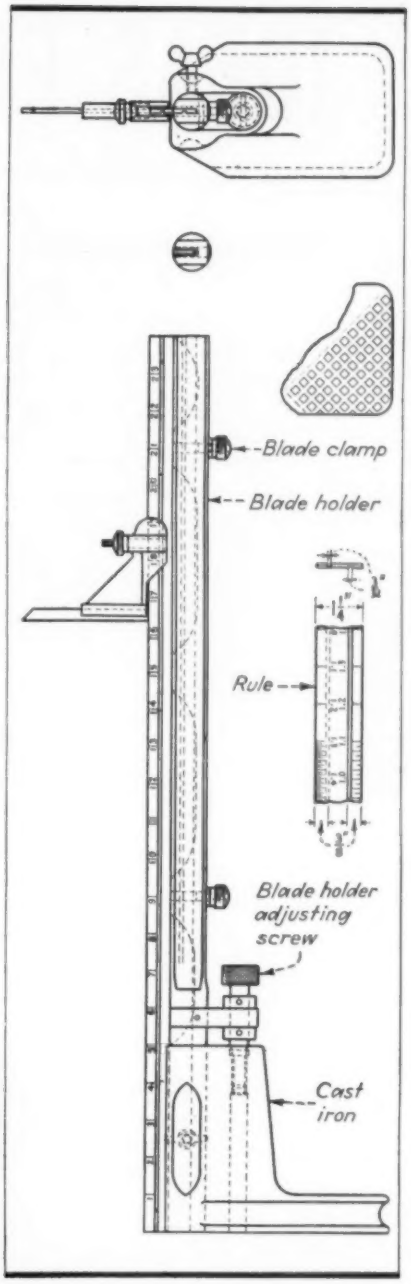
BY ARNO ELSNER AND CARL H. WELCOME
PACKAGE MACHINERY COMPANY

THE SCRIBER on the illustrated height gage can be adjusted by setting it against an assembled stack of gage blocks where precision is essential, or it can be set within the usually required limits of accuracy by adjusting the scriber slide according to gage-line readings on the 24-in. rule which is a principal part of the instrument. The base and blade holder are of sufficiently heavy section to insure rigidity, even when the height gage attachment holding the scriber blade is at the top of the scale. The blade holder can be adjusted vertically in the base almost one inch to bring a gage line on the rule in line with a gage line on the part to permit scale measurements from this line.

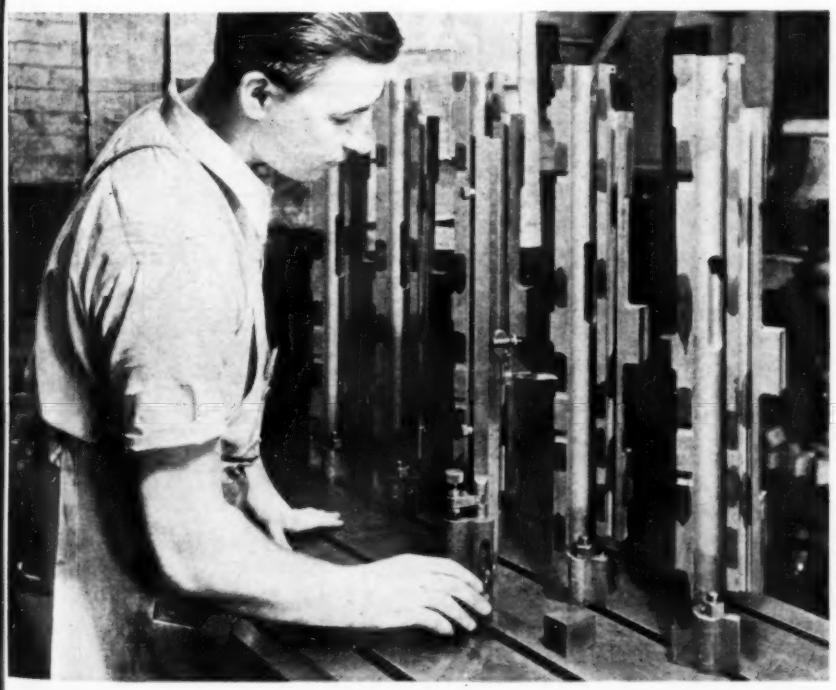
The gage assembly consists of a special alloy cast iron base, a 24-in. long blade holder machined from a $1\frac{1}{8}$-in. diameter rod of tool steel, a graduated steel rule, and a standard height-gage attachment purchased from a regular supplier.

The bottom surface of the base is cut with two series of $\frac{1}{16}$-in. deep grooves at right angles to each other to provide raised squares over the entire area. The grooves are cut on $\frac{5}{16}$-in. centers, making the raised surfaces about $\frac{3}{16}$ in. square. The 1-in. hole drilled and reamed in this base casting to fit the blade holder must be at right angles with the bottom surface if the gage is to be accurate. Likewise the bottom area must be ground or scraped to an accurate plane surface.

With the rule 0.10 in. thick, the blade holder is slotted to a depth of $\frac{5}{8}$ in. for its entire length with a 0.090-in. wide slitting saw. Width of the slot must not exceed 0.010 in., as the rule must fit snugly at the clamping positions. The rule slot is enlarged to a depth of $\frac{21}{32}$ in. with a $\frac{5}{32}$-in. wide slitting saw 3 in. in diameter at four positions along the length of the holder as shown. This insures more accurate seating of the rule in the holder. It is essential that the 0.090-in. wide slot in the holder be accurately parallel with the axis of the 1.000-in. diameter section at the bottom of the holder, as it is this section that fits in the reamed hole in the base casting and determines the relation of the rule with the bottom surface of the base.



Precision measurements can be made with the gage because of its accurate construction. Spring loaded clamps keep the reversible rule from slipping



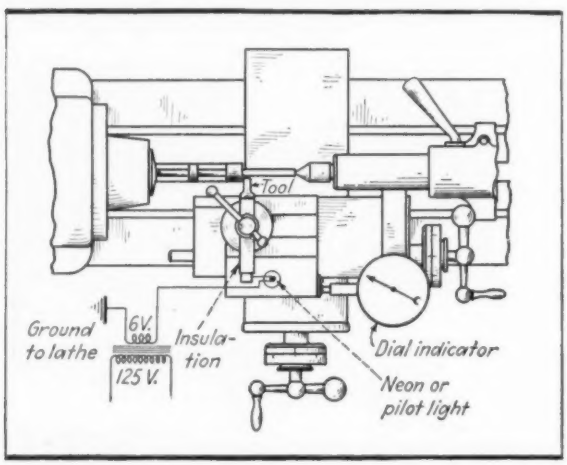
Height settings of the scriber are quickly made on this improved height gage. This tool has been used in the shop for laying out castings for machining operations of every description

IDEAS FROM PRACTICAL MEN

Minimizes Error in 0.00005-In. Lathe Work

By M. M. CUNNINGHAM
General Electric Company

The possibility of error in precision lathe work requiring an accuracy of 0.00005-in. has been minimized with the aid of the pilot-light indicating set-up



A pilot light is used in this lathe set-up to reveal the instant when the tool contacts the work. The indicator is then set at zero, from which point the depth of cut can be controlled accurately

shown in the drawing. The method eliminates the human element inherent in the old practice of using a magnifying glass to see when the tool makes contact with the surface to be cut. Electrical contact between the tool and work is used to close a light circuit, telling the operator exactly when to set the dial indicator at zero, thus establishing a sure basis for making a cut within the required accuracy of the finished work.

The tool is brought up to the surface to be cut in the regular manner, until it is just about to make contact. From this point on it is brought up very slowly until the pilot light flickers. Very little further movement is required until the light is steady. When it is, the indicator is set at zero. A cut of any desired depth can then be made with the accuracy of the cut dependent only upon the accuracy of the indicator and its reading. If that is set and read correctly, there can be no error.

Either an incandescent or a neon indicating lamp can be used for the pilot light. A small transformer reduces the standard 110-volt circuit to 6 volts for the detecting circuit. One line from the transformer is connected to the bed of the lathe, and the other line to the screw shell of the light socket. The center contact of the light socket is connected to a metal strip which makes contact with the lathe tool, being set against the tool when it is locked in the toolpost. The tool is insulated from the toolpost with a piece of varnished cambric or light cardboard.

This pilot light indicating method can also be used where the work is stationary, such as on milling machines, by insulating the work from the machine and connecting the center socket of the light to the work.

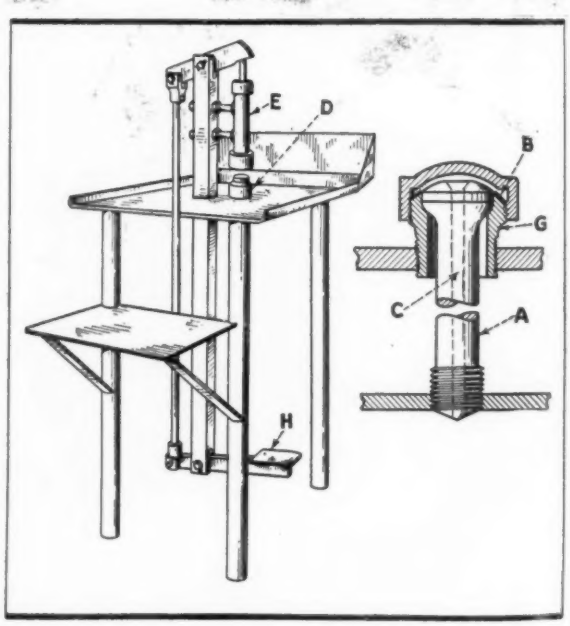
Reclamation of Locomotive Staybolt Gaskets

By OSCAR HEUER

The hundreds of gaskets removed from flexible staybolts in locomotive firebox wrapper sheets are often so distorted that they cannot readily be reclaimed. These staybolts *A* require gaskets *B* to prevent steam leaks around the locomotive cab in case the staybolt breaks. When broken, steam escapes through the telltale hole *C* into the cavity beneath the staybolt cap.

An eastern railroad devised the tool shown in the drawing to reclaim these gaskets. It consists of anvil *D* and hammer *E*, the head diameters and shoulder contours of which are the same as the gasket and the seat in the threaded head of the staybolt.

After the gasket has been annealed by heating to cherry red and quenching in water, it is dropped over anvil *D*. The operator depresses foot pedal *H*



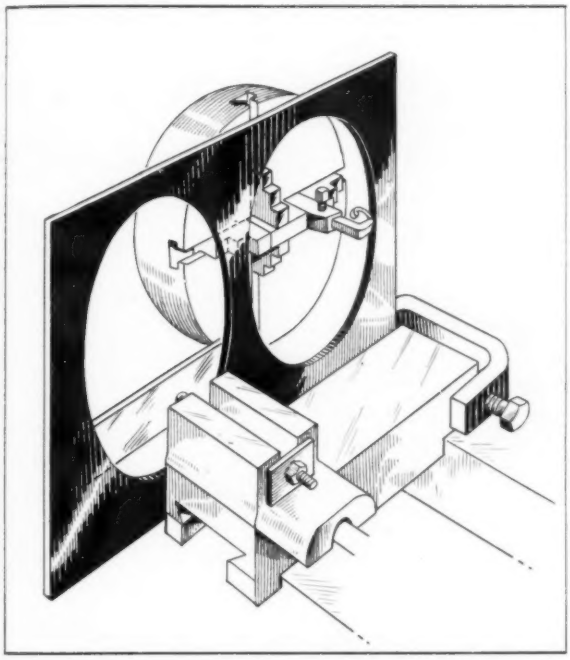
Twisted copper gaskets removed from flexible locomotive staybolts are annealed and reshaped over the anvil of this tool

with sufficient force to drive hammer *E* down on the anvil until the gasket is flattened. Several blows on the anvil are usually sufficient to return the gasket to its original shape. However, should the gasket still be uneven, it can be reannealed and once again placed on the anvil for straightening.

Using a Lathe for a Boring Mill

BY GEORGE HOLMAN

Recently a small shop without a boring mill was asked to machine 12-in. holes in 18×36-in. cast-iron plates. No lathe in the shop could swing these plates,



Large holes in cast-iron plates were machined in one shop by chucking the tool and clamping the plates to the lathe carriage

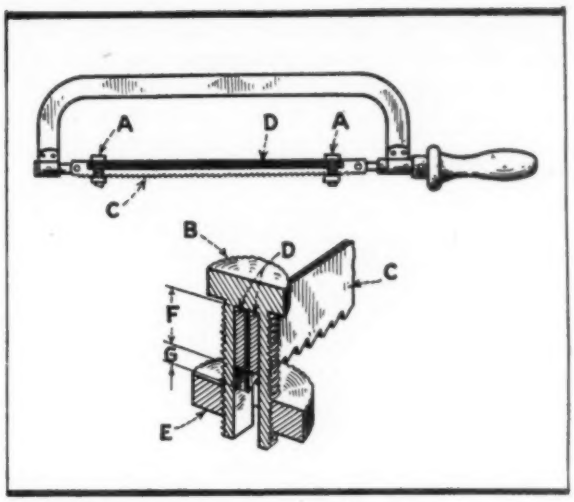
and it was decided that machining the holes with a centered boring bar would be too expensive because of the time required. An operator solved the problem by the method shown in the drawing. The plates were clamped to the lathe carriage, while the tool was locked between the jaws of the chuck.

Limiting Depth of Saw Cuts

BY H. G. PACK

It is frequently desired to limit the depth of hacksaw cuts, as for example in cutting armor from the ends of BX cable for making connections. In this way the armor can be cut without injury to the wires.

This can be done with the aid of two wire clamps, commonly called Kearney clamps, set on the hacksaw blade as shown at *A*. These clamps have a slotted bolt *B*. The bolts are placed on hacksaw blade *C* and two metal strips *D*, set alongside of the blade,



Two metal strips, held on each side of the hacksaw blade by slotted bolts, regulate the depth of saw cut

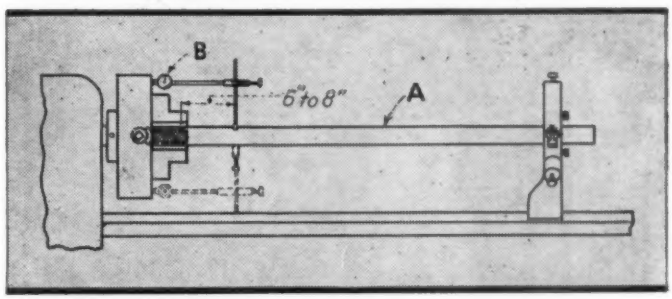
are held as assembled by tightening nut *E*. Width *F* of the metal strip controls depth of cut *G* made by the blade. The assembly is easily removed for replacing blades and for regular work.

Accurate Adjustment of Steadyrests

BY FRANK E. McLANE

It has been common practice when using a steadyrest in a lathe to scribe cross lines on the end to be centered, using the center head of a combination square. The work is then chucked and supported in the steadyrest. Afterwards, the tailstock center is brought up close to the end of the work to note if there is any variation from the center indicated by the cross lines. If such variation exists, the steadyrest jaws are adjusted until the centers are in line.

Very often a job is too long to fit between centers,



Inaccuracies in tailstock centers or steadyrests can be checked and corrected by clamping an indicator on the work near the headstock and revolving it

or it is impossible to get the carriage behind the steadyrest. The tailstock center may be badly out of alignment, which is sometimes not noticed by the operator, thereby causing the work to become loose in the chuck and produce inaccurate and out-of-round work. The steadyrest can be adjusted or aligned by the following method that does not require either

the laying out of cross lines on the end of the shaft or the use of a tailstock center.

First indicate the work *A* true at the chuck or headstock end, leaving the other end in the steadyrest. Then clamp an indicator *B* about 6 or 8 in. from the chuck on the shaft, as shown in the drawing. The farther the distance out from the chuck or faceplate, the more accurate will be the reading. While fastened in this position, revolve the chuck and indicator by hand, stopping at each quarter revolution. The indicator will register plus or minus if the steadyrest or center is not in alignment with the spindle. Raise, lower, or move to one side the steadyrest adjustment or tailstock center, whichever the case may be, until the indicator does not register while revolving the work.

Steel Replaces Brass for Locomotive Bells

By CHARLES E. COE

A steel locomotive bell weighing only 55 lb. compared to the 131 lb. of the old brass bell, has been fabricated and placed in service by the Erie Railroad. It has a clear tone and ample range to warn of approaching trains at crossings.

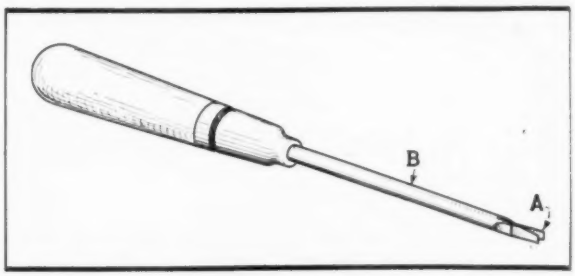
A trifle larger than the brass bell, but much thinner, the new unit consists of a drop-forged top piece and a plate steel skirt that is bent and flared to shape. After welding the two parts, the assembly is heated and pressed in mating dies to standard uniform shape. Thirty-nine bells have already been fabricated for service on Erie locomotives. Old brass bells are headed for the war scrap pile as quickly as they show wear or become cracked.

These steel locomotive bells are fabricated from a drop forging and flared plate. Each bell placed in service results in salvaging 131 lb. of brass

Driver for Starting Screws

BY AUGUST KUEHN

Screws can be readily started in comparatively inaccessible locations by using the screwdriver shown in the drawing. The end of screwdriver *B* was blunted and a slot was cut down into the end. Two short lengths of spring steel *A* were cut to fit into the slot and protrude a short distance beyond the end. These pieces of spring steel were bent so that they are slightly parted at the end. They are then brazed to the end of the screwdriver.



Screws can be started in inaccessible places with this screwdriver with a tip for holding screws

In use, the spring steel ends of the driver are compressed and slipped into the slot on the end of the screw. They spring apart and hold the screw for starting. It is necessary to use a standard screwdriver for driving the screws home after they have been started.

Reclamation of Grinding Wheels

BY PAUL GRODZINSKI

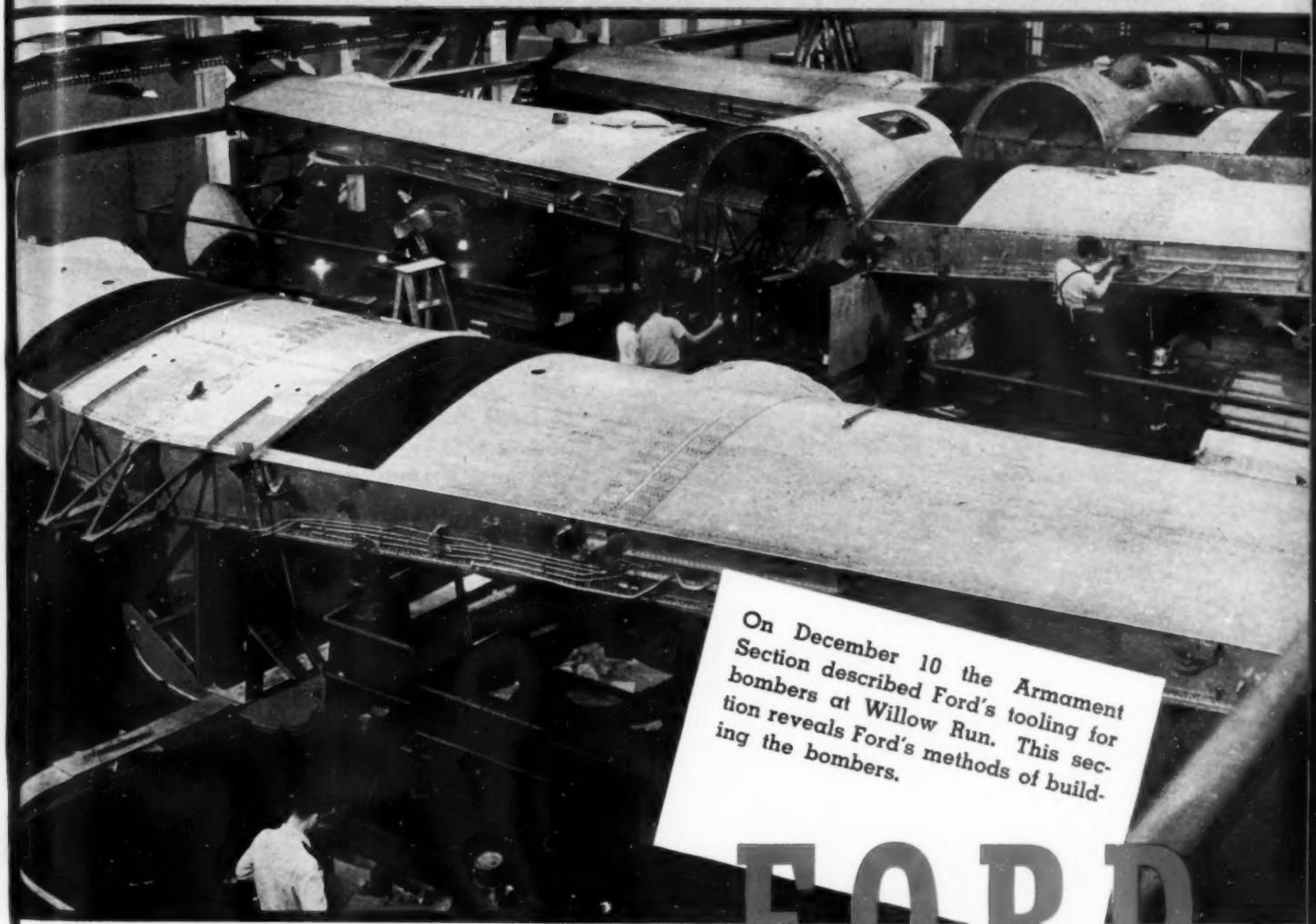
Some metal-working companies in the United States and England during the present emergency have been reclaiming grinding wheels. One procedure is to standardize on the size of arbor holes and use worn wheels successively on as many as three machines. The wheels are recut to size, counterbored if necessary, and speed tested to determine the spindle speed required to produce the correct peripheral speed at the surface of the wheel. The wheels can be turned to the new diameter by using a diamond tool. When it is necessary to saw the wheels, as practiced extensively in Europe, a thin steel blade provided with inserted diamonds is used.

Another practice in reclaiming grinding wheels is to design them for sectional bonds; that is, having one bond and grain size from the outside diameter down to the decided diameter, and another grain size and bond from that diameter to the arbor hole. When using this method, the spindles of the grinding machines can be set for the speeds necessary to produce the required peripheral speed of the wheel.

Another way to reclaim grinding wheels is to cut from them small grinding wheels by using double drill bits which produce both outside and inside surfaces at the same time. By proper layout, nearly the full area of the grinding wheel can be reclaimed.

Armament

SECTION OF AMERICAN MACHINIST



On December 10 the Armament Section described Ford's tooling for bombers at Willow Run. This section reveals Ford's methods of building the bombers.

At the start of the final assembly line, wing center sections are lowered to locating pillars for the mating operations

FORD APPLIES MASS PRODUCTION TO BIG BOMBERS

FORD-BUILT giant four-motored bombing planes will soon be winging their way over European and Pacific battle fronts. Already they are rolling off the Willow Run assembly line in ever increasing quantities. In addition this plant is supplying major subassemblies to other aircraft builders in Texas and Oklahoma.

The B-24, or Liberator, as the British have christened this 30-ton battleship of the air, has already given a good account of itself in combat. Developed and built originally by the Consolidated Aircraft Company, the Liberator has displayed its power over Italy and in the Near East. The large numbers of this battle-proved design being sent to our air forces seem certain to earn the promise of their name to the many countries occupied by the Axis. Willow Run was first conceived as a parts plant

—a supplier of wings, fuselage sections, and other large units that go to make up the Liberator. Then it was realized that the quantity output contemplated would make parts available for a final assembly line at Willow Run as well as for the plants of other plane builders. So today Willow Run is filling its dual destiny, a parts plant and a complete aircraft producer under a single roof.

Ford's philosophy of production is back of all the planning and tooling at Willow Run. The objective was to combine the best in automotive experience and in aircraft technique—to simplify methods by concentrating on one model of a single powerful ship—and to achieve the highest production rate that has ever been attained in the history of aviation.

More than 250 engineers and experts went to the Consolidated plant in San Diego to study methods used there and how to improve them. The tooling finally evolved is revolutionary in aircraft manufacture.

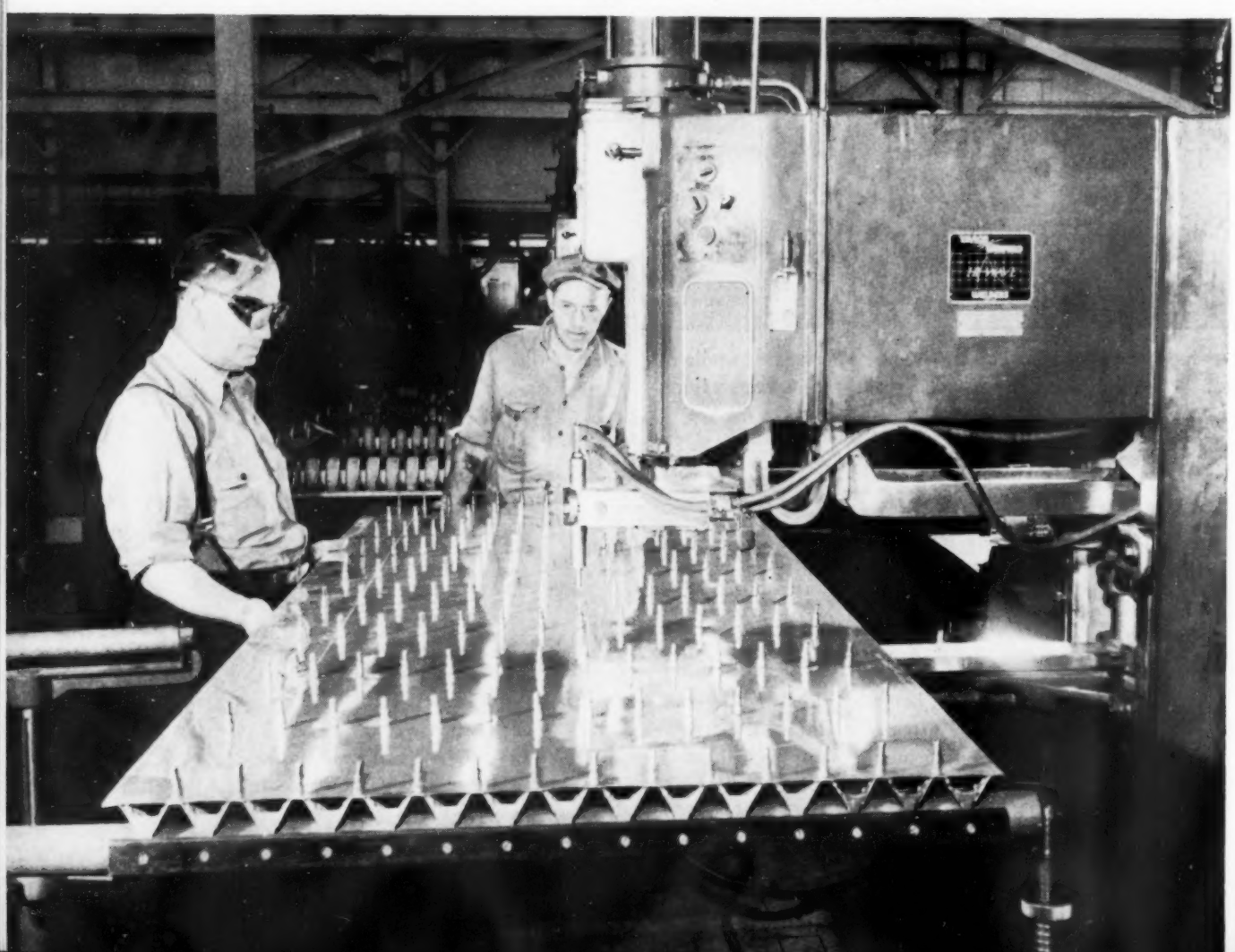
Willow Run tooling for the B-24 is based on permanent fixtures and precise interchangeability. The automobile body building experience of the Ford organization is discernible throughout the operation but with elements of size far beyond anything known to the automotive industry.

Some 13,000 dies for sheet metal are used at Willow Run. Nearly all of these are made of steel or cast iron; a few blanking dies use a Kirksite female section. No rubber pads or hydropresses are employed. Hard metal dies subjected to severe service are chromium plated on those portions where the wear is greatest, with good results. Experiments with heavy drawing compounds have also lead to longer die life. Altogether over 400 presses are now in use on the Liberator.

The plant itself is roughly three-fifths of a mile long with L's at either end extending in opposite directions. These L's, including the portion of the main building that they intersect, present a wall surface of about one-quarter of a mile at each end of the plant.

One of these L sections is used for manufacturing —machine tool, shear and press work as well as perforating and heat-treating parts for the B-24.

About 1900 spot welds are made in each bomb-bay door upon a Taylor-Winfield welder equipped with a pneumatic hitch feed, which spaces the spots evenly along parallel seams



The main section of the building is divided in two down the center, not by a wall, as the entire floor area is one open space, but in accordance with the type of work to be performed. One side of the building is devoted to parts fabrication with departments arranged to feed into the assembly line in order to keep material handling at a minimum. The other half of this area is devoted to fuselage and wing assembly and the final assembly.

Bomb Bay Doors Automatically Welded

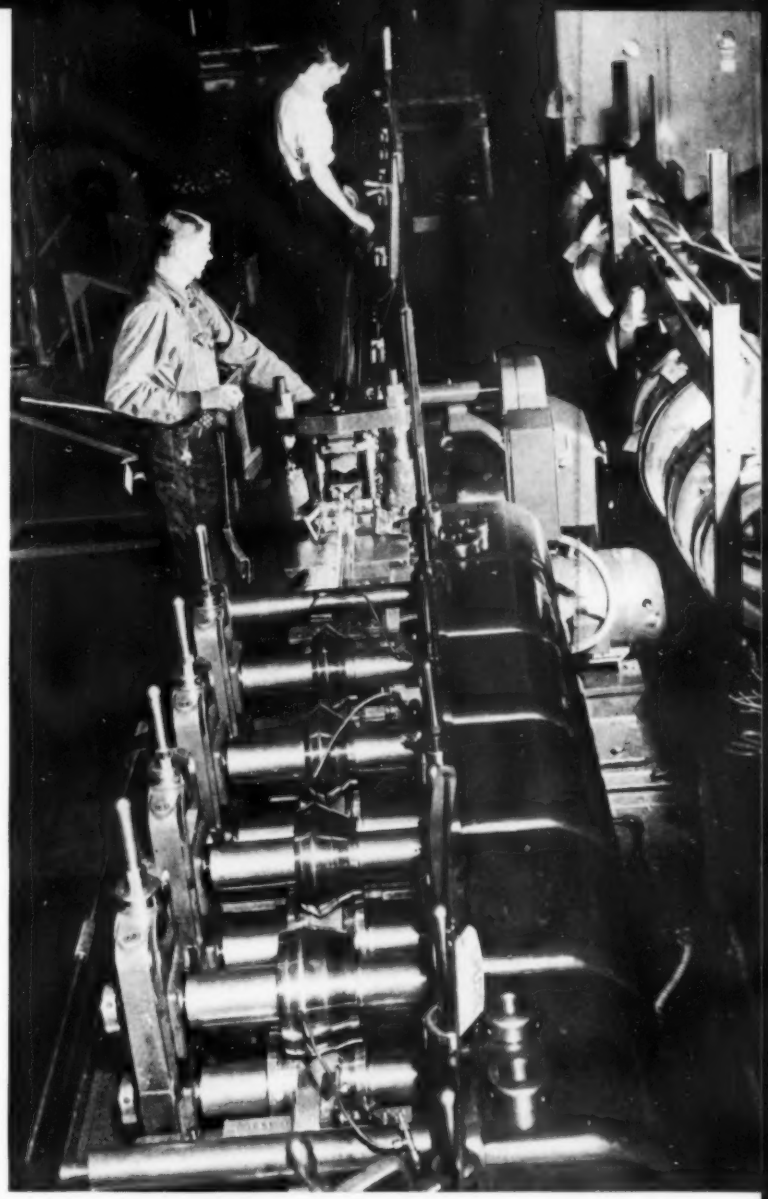
Bomb bay doors for the B-24 are fabricated from two sheets of Alclad duralumin, one corrugated in a press and the other flat. In order to insure a good joint when they are spot welded together, the sheets are cleaned mechanically by passing them through a series of wire brushes spaced along a roller to match the spot-welded seams.

The machine for doing this work is Ford designed and includes auxiliary rollers for feeding the sheets under the brushes. If the edge of the sheet were fed into the revolving brushes an excessive amount of metal would be removed at this point; in order to prevent such action only the feed rollers revolve when the machine is stated. As the sheet is fed it strikes an electric trip which starts the wire-brush roller as the edge of the sheet enters it. The action of the brushes is to remove all aluminum oxide that would prevent a clean weld.

The corrugated and flat sheets are tack-riveted together through holes previously drilled in a horizontal locating table. Holes for the roller brackets are drilled in the same setup.

The tack-riveted subassembly is then taken to a Taylor-Winfield Hi-Wave spot welder which has been equipped with a metered feeding device. This mechanism moves the sheets intermittently through the electrodes by means of an air-operated piston; it is connected to the welder controls so as to make the process automatic. Thus the spot welds are evenly spaced along each seam. The welding operation is performed within an hour after the skin and webbing have been mechanically cleaned so new oxide will not have a chance to form.

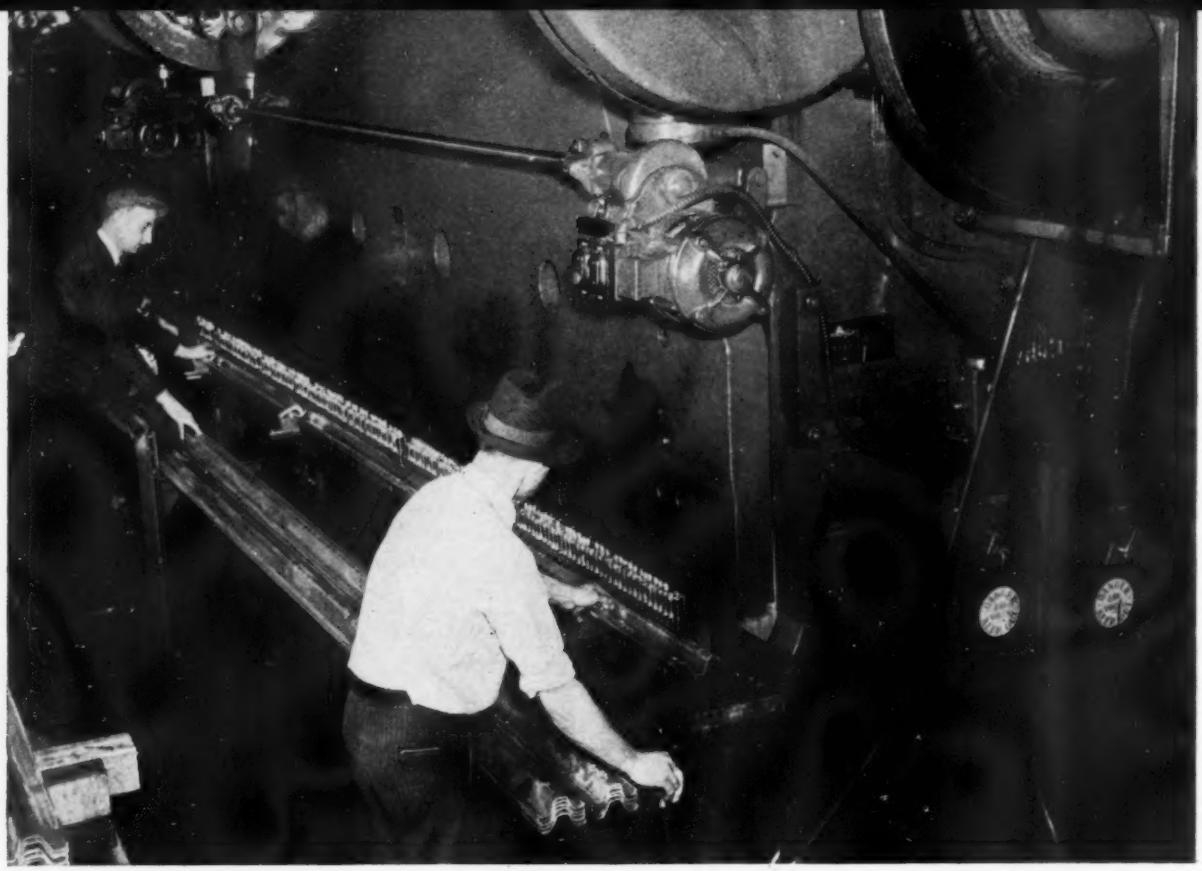
Spot welding is done on only the upper half of each door. The lower half is riveted to give the extra strength needed to stand the concussion of machine gun blasts. Rivets are driven in an Erco punching and riveting machine which automatically punches each hole and then shifts the operating point to insert and head each rivet at a rate of 45 per minute. Rivet spacing is the same as for the spot welds. The roll brackets are then assembled to the door by means of squeeze rivet guns. Graphite-impregnated plastic rolls which are self-lubricating are held to the brackets by means of screws which also act as axles for the rolls.



Stringers are produced from coiled aluminum strip by roll-forming on Yoder mills. These machines produce some 700 different channels, angles and more complicated cross-sections at a high rate of output

The action of the door in the bomber is much like that of the lid of a roll-top desk. The rollers move in channels, bent to the curvature of the under part of the fuselage, when the door is driven by fiber sprockets. Each rivet and weld, 108 in each row, is carefully examined by an inspector before the door is passed. As an additional precaution each door is placed in a fixture equipped with similar sprockets and channels bent to the same contour as in the finished bomber. Here it is given an operating test to demonstrate that it will not bind. Doors are then set up in racks to be transferred to the paint shop.

Every effort has been made to make Willow Run as self-contained as is practical. Instruments, armament and other special parts are purchased from



As many as 200 rivet holes are pre-punched at one time in ribs and stringers by setting up standard Strippit punches on a Cincinnati press brake

outside vendors as are aluminum alloy forgings and sheets. However, from these parts and raw materials processing is complete inside this one building to the final delivery of the bomber. Ford's aluminum foundry at River Rouge supplies castings for the B-24.

In order to simplify the purchase of the many grades of sheet duralumin that are used in the bomber, all such material is ordered in standard widths most economical for the parts to be fabricated from them. Stringers for wing and fuselage sections use narrow strips and these are obtained by cutting up the wide sheets in Yoder rotary slitters. Strip width is held to 0.002 in. in these machines, and the sheared strip is wound on reels for convenient handling.

In order to obtain the desired cross-sectional shape for the stringers, the strips are run through Yoder forming machines, which by means of a series of rollers, transform the flat stock into channels, angles or more complicated shapes as called for in the design. At the end of each roll-forming machine, a shearing table is located so that the formed sections may be measured and sheared to length without further handling. A helper guides the formed strip against a stop clamped to a pull rod which trips the shear to obtain the desired length automatically.

According to Willow Run practice, rivet holes are prepunched in all ribs and stringers 1-32 in. undersize. For this purpose four Cyril Bath bending presses and two 18-ft. Cincinnati brake presses are available. Standard Strippit punches, used with these machines, are located along the press table by means of a master stringer which is painted red for quick identification. When all the punches have been set the workpiece is held down by means of screw clamps and punched.

Some of the stringers have to be bent to shape after forming and perforating. This work is done on three different types of machines. The Apex Metal Specialties Company bending machine has a circular table upon which a form is placed that will give the desired contour to the workpiece. One end of the stringer is clamped to the form and rotated by power while a follower is held against it by means of a pneumatic cylinder. Another method is to use Buffalo roll-bending machines in which simple curvatures can be obtained. These machines use three rolls through which the stringer is fed by power, the position of the rolls determining the resultant radius. A few hand-bending machines complete the equipment.

Aircraft manufacturers have recognized the importance in heat-treating aluminum parts of quenching them as soon as possible after they have left the furnace. The thin sections used in aircraft cool quickly, and if permitted to drop below their

critical temperature in air, they will not be hard enough and hence unserviceable for their intended use. Accordingly special provision is made to quench such work within four seconds after it leaves the furnace.

At Willow Run this is accomplished by building each heat-treating furnace and spray booth as an integral unit. Each unit consists of a heating chamber with a quenching chamber adjoining it. Both chambers are equipped with doors at each end.

The parts are mounted on racks provided with cross arms about 3 ft. apart to give good support to the work. These racks are carried on power driver under-carriages by means of a series of rollers. The rollers are driven by an electric motor through a Cleveland reduction gear to act as a conveyor in feeding the racks into the furnace. Similar rollers inside the furnace and spray booth carry the racks from one position to another as desired.

The loaded racks are first fed through the spray-booth into the heating chamber directly behind it. Then the doors are closed while the load is raised to a temperature of 920F. and held for a period of a half to one hour depending on the shape and the thickness of the stock. After this soaking period, the furnace doors are opened and the conveyor rollers are reversed to transfer the rack to the quenching chamber. The doors are again closed, and the sprays are turned on discharging water at the rate of 2800 gallons a minute. The entire operation is automatically controlled according to a predetermined time cycle.

After leaving the heat-treatment, stringer sections are straightened in Ajax metal stretchers. The 3½ percent stretch which the stock receives in these machines not only removes distortion, but slightly cold works it as well. The 35-ton hydraulic pressure, available for this work, is shut off automatically when the desired length has been reached.

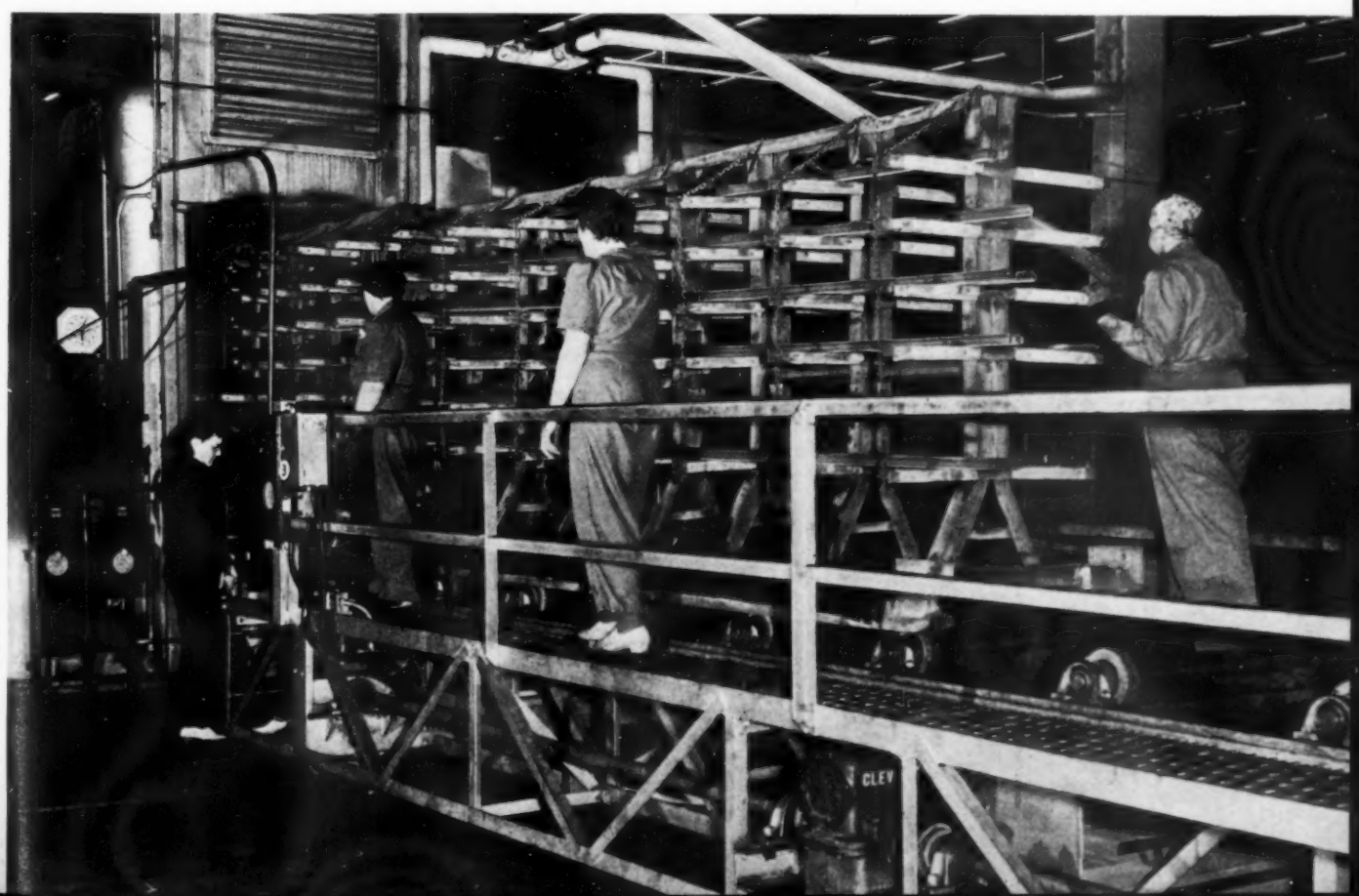
All parts go through an inspection department where they are examined for dimensions and for hardness. The latter characteristic is determined by a Rockwell hardness tester.

In order to get the desired production, it is necessary to break down the bomber structure into seventy major subassemblies. The main consideration is the time cycle for each fixture which must be accurately timed to fit into a coordinated plan.

Willow Run fixture design is based on the use of permanent tooling, securely mounted and aligned. Fixture foundations are made by removing a section of the wood block flooring and bolting the supporting frame to the solid concrete beneath.

After studying aircraft practice, Ford engineers

Power-driven rollers in the charging carriage permit fast loading of the combination heat-treating furnace and spray-quench booth. Women easily guide racks filled with aluminum stringers into the spray booth, where rollers drive them onward to the furnace



decided on the use of cast steel supporting frames for most of their assembly fixtures, a construction that gives maximum rigidity. As an example of the massive construction employed, a single center wing fixture weighs 27½ tons.

The practice of using lengths of pipe or tubing for fixture frames was rejected by Ford engineers because of the fear that such supporting members might get out of line.

Fixtures vary in size and design in accordance to their use. However, certain characteristics are common to all of them. The supporting framework carries the working surfaces of the fixture to which are attached suitable locating points and clamps for holding the bomber components during assembly. In building the fixture, these points are positioned by the use of master dummies built of rigid steel construction. Once the fixture has been set up, its alignment is assured by its rigid construction, but in case it is necessary to check it from time to time, the master dummy can be put back into place. The dummy for the center wing section is cross braced and welded together; it weighs 8 tons.

The general procedure followed in assembly is pretty much the same for most fixtures. The heavier longitudinal members are located first and to these the ribs or bulkheads are attached. Then the stringers are located on the ribs, and finally the skin sections are added. Since ribs and stringers are prepunched before reaching the assembly floor, the holes serve as locating points when the parts are located in the jig. These holes are then drilled to their full size through the two mating surfaces with portable pneumatic drills. Opening the prepunched holes by drilling during assembly removes any burrs or stressed areas surrounding the perforation. All fixtures are fully equipped with compressed air lines to supply the pneumatic tools and built-in lighting fixtures so that the work is well illuminated in all positions.

Fixtures Can Be Altered

Because of the permanence of the fixtures, the question is sometimes raised as to their flexibility to meet design changes or other desirable alterations. The fixtures are designed with such contingencies in mind. Usually the cast framework is built a few feet longer and wider than needed to carry work-supporting sections of the fixture. This construction makes it possible to alter locating points and clamps in order to accommodate such changes without disturbing the main body of the fixture.

Stringers distort in the heat-treatment, hence are gripped in an Ajax hydraulic stretching machine which stretches them approximately 3½ percent, removes curvature, slightly cold-works the metal

A typical fixture is that for assembling the upper front deck of the fuselage nose section. This is the section of the fuselage directly ahead of the pilot. The fixture consists of a vertical cast steel frame tied together by a top plate. Inside the frame vertical cross members approximate the contour of the subassembly. To these cross members, locating points and clamps have been attached by positioning them from a master steel dummy. The clamps used throughout the Willow Run are standard commercial products whenever it is possible to use them. On this particular fixture a standard toggle clamp is used.

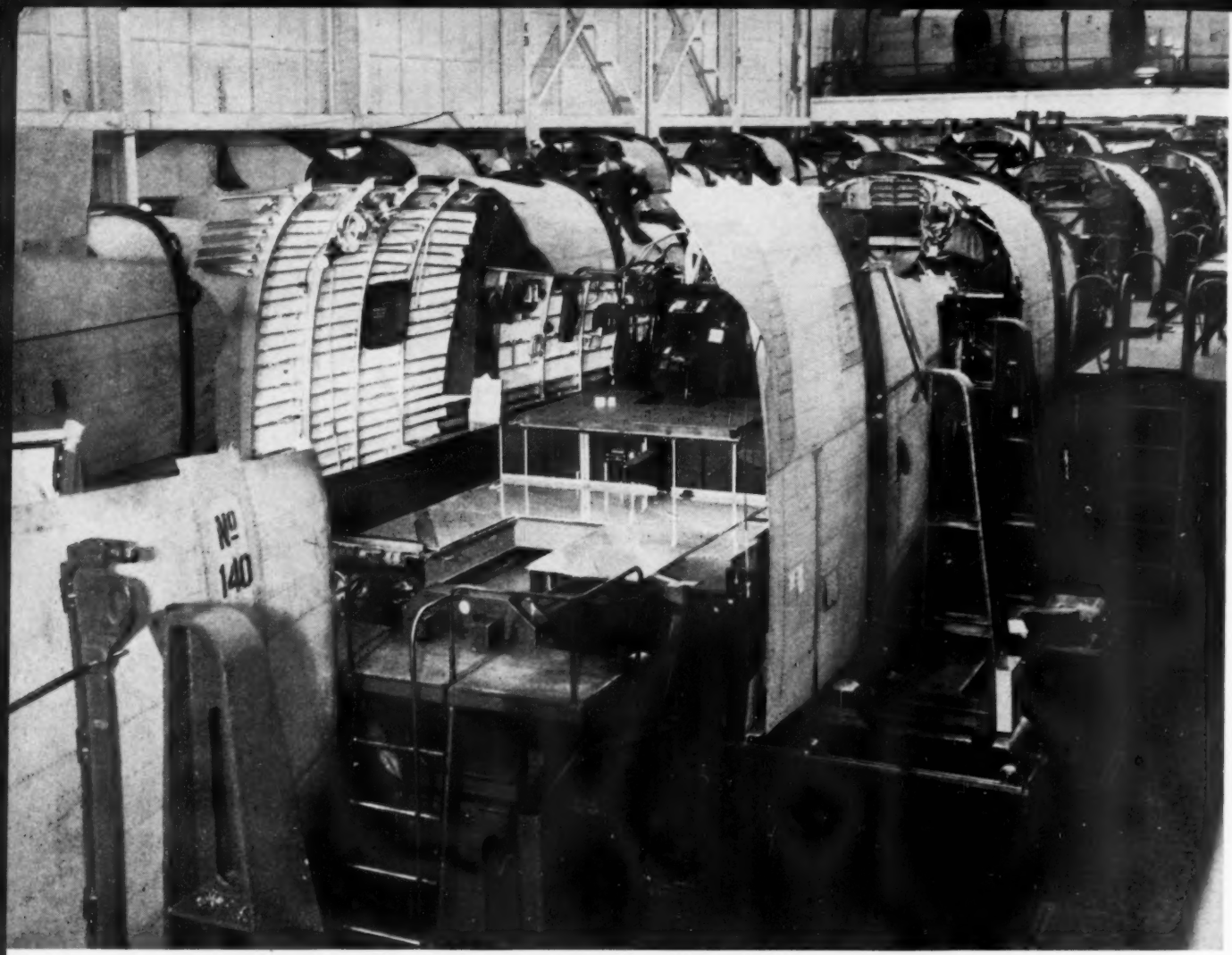
Elevators Make Work Accessible

This fixture is provided with elevators, front and rear, to put the assemblers in the most convenient position for working on the section. Elevators are provided with guard rails and wooden floors to give comfort and safety to the operators. They are counterweighed, in this case, on the basis of five operators occupying the platform. On some of the larger fixtures using this construction, provision is made for ten operators. The elevators are driven by a vertical motor, acting through a gear reduction and a worm wheel. The mechanism drives a pinion which engages a rack in one of the vertical supports to elevate and lower the platform. Elevators are an integral part of many of the B24 fixtures; their use avoids the use of pits in the floor which would otherwise be required to make working surfaces accessible, since the fuselage front deck fixture is typical of many in the Willow Run plant, it can readily be seen how the working surfaces can be changed to meet alterations in design without disturbing the elevators or the main frame in any way.

All fuselage panels are coordinated by means of locating straps which become an integral part of the panel when it is first assembled. The straps are positioned in the panel fixtures by means of master pins, top and bottom, and are bolted through the skin to the bulkheads; there are two to each panel.

The importance of the straps is that they position the various panels when they are put together. Both front and rear fuselage sections have upper and lower cleavage lines which separate the side panels from the upper and lower panels. The ends of the locating straps fit together and are positively positioned by shoulders and bolts. Since the straps are fixed in place when each fuselage panel is originally fabricated in its fixture their mating surfaces serve to fix the alignment of the entire fuselage.

Locating points in Willow Run fixtures were positioned correctly during fixture erection by means of master steel dummies of the finished assemblies



Assembly of the fuselage-nose side panels to the pilot's and radio operator's floor is promoted by vertical frames sliding on tracks to establish the correct distance from the plane centerline

For many subassemblies it is desirable to change the position of the work as the operations progress. For drilling holes and driving rivets, it may readily be seen that the underside of many sections is difcult to reach. If the operator is placed in an awkward position his progress is retarded and he tires more rapidly. This is particularly true in bucking rivets overhead. For this reason, a large number of trunnion fixtures are used at Willow Run. They consist of upright cast iron stands carrying bearings in which the framework of the fixture is pivoted. The stands are provided with cranks which drive self-locking worm and wheel mechanisms to rotate the moving parts of the fixture.

In order to synchronize the angular motion in both stands, the larger trunnion fixtures are tied together by means of a shaft which runs along the floor and is connected by means of bevel gears to the rotating mechanism. Its use prevents any twist in the fixture frame which would tend to dislocate the locating points.

For the B-24 bomber, Ford tool engineers have standardized on two sizes of trunnion supports which can be used with a wide variety of fixture frames and are amply heavy to support the largest subassembly that is handled in this way.

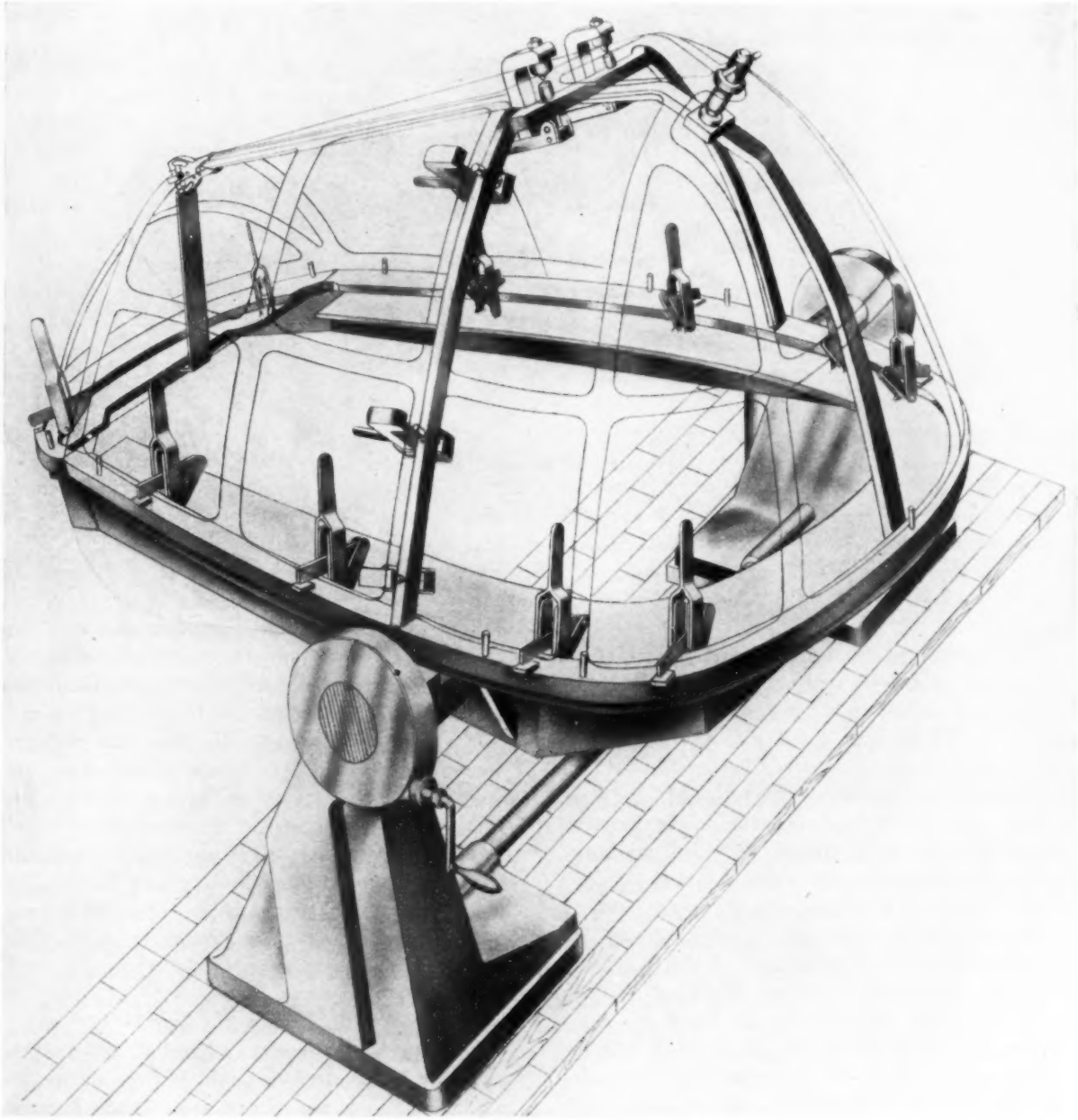
One such fixture is used to assemble the rear fuselage bottom panel. Another is used on the pilot's and radio operator's floor assembly. This latter application is of special interest because, for this assembly, thirty such fixtures are mounted on a merry-go-round conveyor. The fixtures are carried around in an oval, mounted on trucks which run on tracks. They are moved by an electric-driven pull chain which runs in a center track. Small subassemblies are prepared in the center of the oval.

The floor assemblies are completed on this fixture including the control column for the pilot and copilot. The controls are already to connect when the floor is installed in the ship. At the stations where it is necessary for the assemblers to work on top of the floor section, guard rails are provided. A lifting fixture goes with the floor to the final fuselage assembly buck to stop transit distortion.

The assembly of the pilot's and radio operator's floor with the forward fuselage side panels brings into use another interesting fixture. Here again heavy cast steel construction is used. The floor is first placed in the fixture on stationary locating surfaces. The side panels, which have been previously assembled, are held on vertical frames each of which is carried by two upright pillars mounted on short sections of track. They are moved inward until vertical dowel pins can be inserted in locating holes, joining them to the stationary structure which supports the floor section.

Since both panels are handled in this way, the distance of each from the center line of the ship is determined. Consequently, the correct width of the fuselage is established in this fixture. This is the first step in combining the panels to form the fuselage nose section.

After the panels are located, the rivets are driven to tie the assembly together. From here the assem-



Trunnion type fixture stands make it easy to reach the underside of large and cumbersome subassemblies such as this nose inclosure. To synchronize the angular motion of both ends of larger fixtures, the trunnion rotating mechanisms are connected by a shaft and bevel gearing

bly goes to a pickup fixture where the operations are completed. This fixture has stages inside and out so the assemblers can work to best advantage. In this setup the side panels are held from their mating straps which set on four pillars. The top panel and rear top deck are then joined to the side panels, positioned by their mating straps. The ends of the straps at each locating point have shoulders to give their transverse position, and vertical keys and bolts which fix their fore and aft position.

A third setup in forming the fuselage nose is to combine the top and side panels with the bottom panels. Here again these various units are held together with the mating straps and riveted. This fixture also has a special locater in the center for positioning the bearings of the nose wheel of the tricycle landing gear. Its purpose is to hold the fuselage assembly in correct position for the forward landing gear, which is a key locating point.

Between this fixture and the final assembly line another pickup station is used which holds the fuselage nose section by the mating straps while the interior furnishings are assembled. The assembly is then completely gone over by inspectors before being sent to the final assembly line. The mating straps go with the assembly to the last mating fixture in the final assembly line.

The aft fuselage section, in general, follows the procedure used with the nose section. The method of building up the panels and bringing them together through the use of mating straps is much the same, but the steps are simplified by the fact that there are fewer units in this end of the fuselage.

Tail Cone Fixture

One fixture of particular interest, however, is that used for the tail cone. This subassembly is completed in a fixture which consists of a cast base and four upright pillars. The locating points of the cone are carried in an overhead frame and on a series of steps in the base. These steps are used by the assembler in reaching points inside the cone. In this way all the rivets can be bucked while the cone is in a convenient operating position.

It is not possible to assemble the lower panel to the cone when the steps are between the two side panels. The fixture takes care of this condition through the use of elevating screws at all four corners. After the work on the inside has been completed, the lower clamps are loosened and the entire assembly is raised 4 ft. so that the lower panel can be attached. The fixture makes it possible for six men to work on the cone at one time. An important locating point on the cone is the rear gun mounting track. Before going to the final aft fuselage assembly fixture, the cone is taken to a pickup station where the interior furnishings are added.

Rivets in highly stressed sections of the B24 bomber are made of dural 17F and heat-treated. They comprise about 20 percent of all the rivets used in the ship. Because of the rapid age-hardening characteristics of the material of which they are made, heat-treated rivets cannot be allowed to lie around at room temperature; after four hours their loss of ductility will make them unsafe for heading in aircraft assemblies.

Rivets Kept Cold

Since low temperatures retard embrittlement, all rivets heat-treated at Willow Run are transferred immediately after quenching to Cold-Hold electric ice boxes where they are held at 5 to 10 F. below zero. Ford tool engineers have equipped these boxes with foot-controlled air cylinders which lift the lids, thus making it easy to remove rivets in the assembly line and minimize the amount of time the boxes are kept open. Rivets are inspected to hardness at the start of every shift. If unused within four days, they are heat-treated over again.

Probably the most important subassembly in the entire ship is the wing center section. The B-24 design is such that this section includes not only the inner portions of the wings which carry the engine mountings and the landing gear brackets but it also forms the center part of the fuselage to which the nose and tail sections are attached. Consequently, accurate fabrication of this subassembly effects the entire alignment of the ship.

The first step is the stringer assembly. The center section wing stringers consist of numbers of rolled aluminum sections, riveted together, frequently dividing into two or more stringer pieces as the wing widens toward its inner end. Stringer assemblies for the upper and lower skins are fabricated separately on positioning tables while held by holes in forgings at the outer ends.

Top and bottom skins are also spliced in separate fixtures. The procedure here is to predrill the splice plates in jigs before assembly. These plates are then positioned in the skin fixture by metal stops on the bottom and sides.

Skin Spliced Separately

The skin is preformed in a Farnham roll and has mastered pin holes through which Cleco clamps are put to hold it to the splice plates. Straps fastened to the top of the fixture are then passed over the skin panels and bolted at the bottom to hold them.

Assembly methods for both the top and bottom

skins are the same. The predrilled splice plates serve as guides for back drilling through the skin. Since most of the skin rivets are countersunk it is necessary to dimple the skin from the outer side using portable tools. Then the rivets are bucked and headed to complete this step. Steel ladders with wooden treads travel on rollers along the length of the fixture so the operators may reach all parts of the work conveniently. The entire fixture is tilted backward 15 deg. to parallel the slope of the ladders and to facilitate drilling and riveting.

The top skin has four panels running vertically in the jig or in the direction of flight. Three bottom skin panels run horizontally in their jigs (right and left) to provide for landing gear wells and fuel cell openings.

Around the landing gear wells four extra skin thicknesses are provided to compensate for the cut-out sections. These skins are built up in still another fixture as a separate operation. Since these skin sections are not predrilled, a combination holding and drilling jig, built into the fixture locates the holes.

The next step is done in the skin and stringer assembly fixture. The stringers are put into place first, located from the holes in their terminal forgings and from notches in formed plates which are part of the fixture; these plates are positioned to correspond with bulkheads in the finished wing.

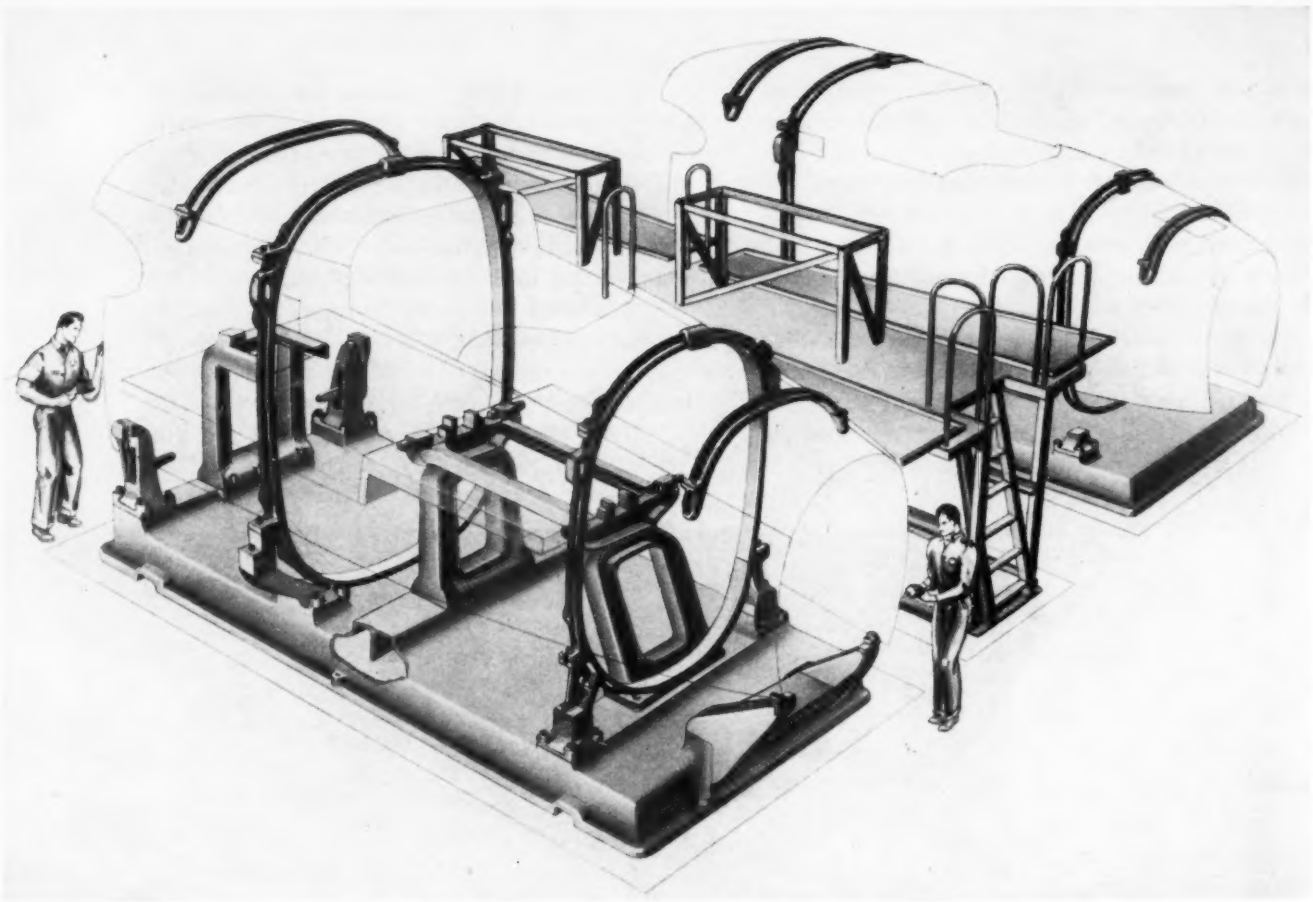
Then the skin is fitted to the stringers, located by blocks at the bottom and sides, and held in place by straps that pull it flat against the stringers. This fixture is equipped with an elevating work platform so that all sections of the subassembly may be reached without effort.

When the stringers and skin panels are drilled, dimpled and riveted, the skin is trimmed at the top and inner ends. For this purpose slides are provided to hold cutting tools which may be hand traversed along the fixture. Since the tool guides are accurately located with relation to the skin stops at the bottom and opposite ends, the position of the trim line is controlled in the fixture. Before the assembly is removed, two formed straps are bolted to each panel to aid in handling the flimsy structure.

The same procedure and type of fixture is followed for both the upper and lower skin and stringer assemblies, and for the right and left hand wings. They are now ready for the final wing assembly fixture.

While this work is being done another set of fix-

The tall side panels of both the forward and aft sections of the bomber fuselage are assembled in fixtures much resembling those used in attaching skin surfaces to the stringers in wing sections. Curved uprights simulate the contour of the fuselage, with notches for positioning the stringers



The pilot floor assembly is held in this fixture while the fuselage nose section panels are added and located by mating straps. These straps go with the assembly to the last mating fixture in the final assembly line

tures is used for assembling the spars and bulkheads. There are four spars for the inner wing section, leading and trailing edge, and right and left side. Each spar and bulkhead is a separate subassembly.

Still another fixture is used to assemble the reinforced skin section around the landing gear well to its stringers and the auxiliary spar and bulkhead to which the landing gear bearing brackets are bolted. In general this fixture uses locating points and clamps similar to the skin and stringer fixtures just described. In addition it is provided with a heavy pivoted arm which is swung into the landing gear well; when doweled securely in this position two plugs on the arm accurately locate the landing gear bearing brackets which are then bolted in place.

This subassembly then goes to the center wing final assembly fixture in which the spars have already been located by pins in the end plates and by coordinated holes, top and bottom. A turret attached to the fixture is swung inward on a circular table and doweled to locate the auxiliary spar assembly. This unit is positioned by plugs which fit holes in the landing gear bearing brackets, already determined as key points in the previous fixture. The locating plugs are then moved inward to clear the landing gear bearing brackets, and the turret is swung out of the way.

The balance of the bulkheads are placed in position on the fixture by holding them in coordinated holes, top and bottom, and all spars and bulkheads are drilled and riveted in place. Then the skin and stringer assemblies are placed over the bulkheads and bolted to them while they are drilled and riveted to the front and rear spar angles.

In order to position the holes for fastening the skin to the spars, drill guides are hinged to the fixture at the top and bottom. These guides serve to clamp the skin place as well as to locate the holes. They may be swung down into operating position when the pneumatic portable drills are in use and up out of the way when riveting. The use of drill guides is necessitated by the fact that neither the skin nor the spars are predrilled. The center wing final assembly fixtures are equipped with permanent upper and lower work platforms.

After the skin is riveted, the motor mount forgings are put into the fixture. Holes are drilled for the side wall attaching angles and the finishing

plates in the joint between the right and left-hand center wings. Lifting brackets are then attached to the top of each wing.

A number of access holes for inspecting and servicing fuel cells are left in the lower center wing skin. These are covered with plates when the ship is in operation but during wing assembly they afford a convenient way of reaching the inside surfaces of the ship for tightening bolts and driving rivets. To reach bolts in such locations a special right-angle pneumatic driving head is employed.

In order to remove the wing from the fixture, the end plates are moved outward on their locating gibs by means of leadscrews operated by handwheels. These plates are normally held in accurate position by pins which must be removed before they can be moved outward.

To provide clearance at the top to lift the wing, the upper boom, which carries all the top locating points, is moved sidewise on a track. First the locating pins are pushed upward to clear the spars. The boom is located in its operating position by heavy dowel pins which must be removed. Since it weighs ten tons, it is power driven by dropping lugs on the boom into notches in a chain conveyor along the outside end of the fixture. When the boom is pulled clear of the wing, the entire assembly is lifted out by means of an overhead traveling crane and is carried to a horizontal pickup station.

In the horizontal position, end plates are put in the outer ends of the center wing section, and the forging holes in each spar are reamed. These plates are used in locating the center wing assembly in a specially designed Ingersoll milling machine which finishes eleven key connecting points in one setup. The machine is really a collection of machine tools accurately positioned on a common baseplate 78 ft. long, 18 ft. wide and 18 in. thick.

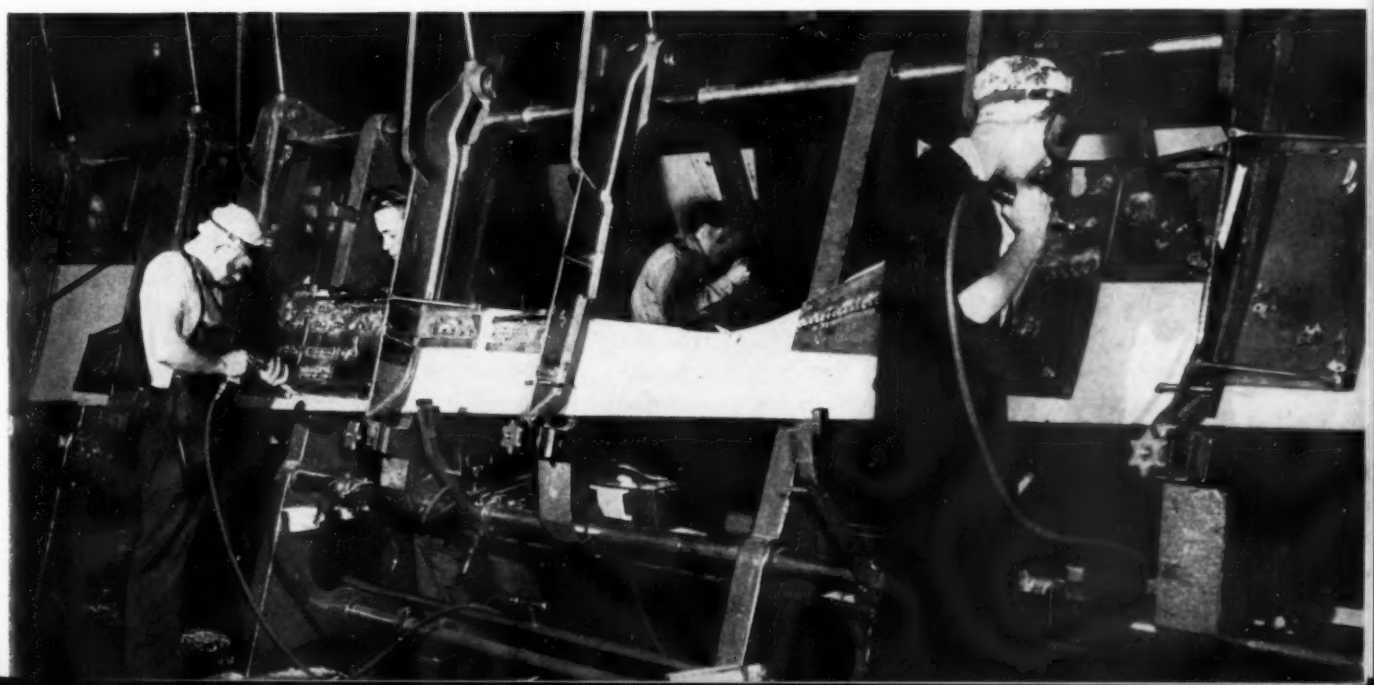
In it, landing gear bearings are bored and faced using a double-ended spindle which is fed first one way and then the other; engine mount brackets, both upper and lower, are drilled and faced; front and rear fillers for the fuselage attaching channels are bored and faced. The machine also has a head at either end that can be used to mill off the splice joint for the outer wings if necessary. These heads are not in service at the present time. The entire boring and milling operation takes about 1½ hours, representing a large saving in time over methods previously employed.

The purpose of machining these various control points in a single machine is to insure interchangeability and correct alignment of all sections of the bomber. Since many of the subassemblies are shipped to other plants for final assembly, the location of the connecting points on the center wing section becomes doubly important.

At this point the center wing section is removed from the milling machine, carried to a transfer dolly, the end plates are removed and trolley plates are added. The trolley plates remain with the assembly until the last mating fixture on the primary final assembly line.

Wheels in the trolley plates move along parallel supporting rails at opposite ends of the wing section. The upper end of each plate engages an endless chain which moves the assembly continuously along the conveyor line in a horizontal position.

Predrilled splice plates serve as guides for backdrilling through the skin when making the center wing final assembly. This fixture predrills the splice plates



Twenty-one operations are performed along this line including installation of the engine mount brackets, landing gear connections, fuselage locating pads, bomb rack fittings, nacelle fire walls and nacelle fairings, landing gear mechanisms, fair leads and pulleys, flap actuating units and the wiring. In ths line, also the leading edge bolt holes are prepared and the location of the four bolt holes for each engine mount is checked.

In order to facilitate this work compressed air and electricity is made available along the line for use with portable power tools. A pipe with compressed air outlets is clamped to the top of the wing section and is connected by means of lengths of air hose to stationary outlets located at intervals along the conveyor rail. By changing the main hose connection from one outlet to the next as the assembly is moved along the air supply is maintained at all times. Sliding electrical contacts travel along a pair of bus bars paralleling one of the conveyor rails to supply this source of power.

After these installations the conveyor rails rise to lift the wing over a spray chamber equipped with exhaust ducts for carrying away fumes and surplus paint. Here the bomb bay areas and the landing gear wells are coated with camouflage paint. At this same station the fuel cell areas and spars are sprayed with a spark-proof varnish.

Leaving the spray chamber the assemblies encounter a second rise in the conveyor which lifts them so the undersides are accessible for installing the oleo struts and landing gear. These are lifted into place by means of a special elevating fixture. Portable hydraulic test stands are used to check the operation of the landing gear.

Assemblies for Other Plants

The conveyor then takes a third rise which lifts all wing center sections to a height of some 25 ft. above floor level. The assemblies to be shipped to other plants are carried at this height to the end of the line where they are picked up by a traveling crane and transferred to trucks on elevated cross tracks to be taken to the shipping department. The lateral flow of these subassemblies at this level prevents interruption to the Willow Run work flow.

Center wing assemblies that are to go into the final assembly at this plant are lowered in an elevator to a conveyor line about 5 ft. above the floor level. Here fuel cells of the self-sealing type are installed. In order to install them easily, a special press has been designed to push in the ends of the cell while a hydraulic ram collapses it. In this position, woven fabric straps are tied around the cell so it may be removed from the press and placed into the narrow wing openings without trouble. When the cords are removed the cell springs back into shape. Superchargers are added to the wing at this point.

While the work on the wing center section has been going on, various smaller components are made up in other subassemblies. For instance the leading edge assemblies are lined up and riveted in separate fixtures. The fixture for the leading edge consists of a number of curved templets so that the bulkheads can be held at the correct locations. These bulkheads are cut out to provide clearance for the deicer tubing. Straps along the length of the fixture hold the skin, which has been preformed in Farnham rollers, securely to the bulkheads. The fixture is pivoted so the inside may be reached for bucking up the rivets.

The outer wing assemblies follow the same general procedure as the center wing sections except that they are considerably simpler. There are no landing gears to be installed and hence no auxiliary spars are needed to form the walls. There are no engine mountings or gas cells to be attached.

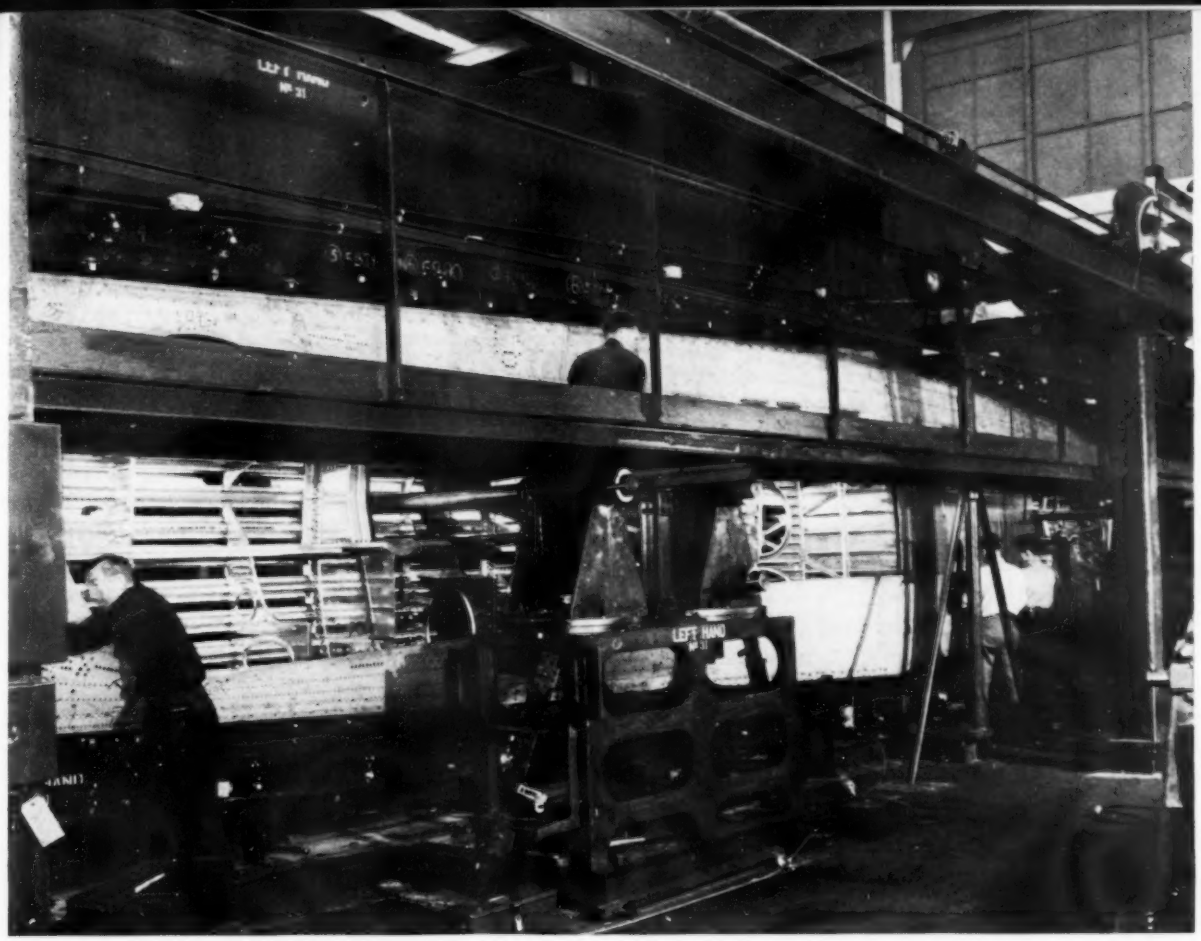
In the absence of access holes to reach points inside the wing for bolting skin panels in place the procedure is altered somewhat. The lower skin and stringer assembly is drilled first and then removed while the upper skin and stringer assembly is clamped in the fixture. The holes are drilled and all rivets are driven between the skin and the stringers. The stringers are bolted to the bulkheads by means of Allen head screws which fit into nuts clamped inside the stringers. Then the bottom skin and stringer assembly is again placed in the fixture and bolted in place.

The final assembly lines are divided into two major sections. The first section consists of four parallel lines along which the assemblies move through twelve stations. The second section narrows down to two lines because of the wider space needed when the outer wings are added.

For the first part of the line, the wing center sections are carried along by their end plates on overhead trolleys. They are moved from one station to the next intermittently by means of a chain conveyor. The trolleys roll along tracks on wheels in the end plates.

Station 1 of the final assembly line is used for adding the canopy, that portion of the top skin directly over the center wing section.

When the wing reaches the first mating fixture, Station 2, the end plates roll onto sections of track that are carried in cast steel end towers by means of hydraulic rams. With the wing section in this position it may be lowered by the rams to



Final assembly of a center wing section is carried out in a two-story fixture over 60 feet long and having two permanent working levels. Bulkheads and stringers are placed in the fixture, then skins are clamped in position, backdrilled and riveted. When the center wing is completed, the top bridge structure of the fixture is rolled to one side and a crane hoists out the B-24's main structural element

four center pillars which provide the wing locating plates in the mating jig. Wing attachment points are recessed to fit spherical locating surfaces in the top of each tower. The assembly is further positioned by a master point on the bottom face of each end plate, which is located from the face of the end tower.

This arrangement holds the wing in flight position, an angle of 8 deg., ready to have the bulkheads, longeron (catwalk) bomb racks and side panels installed under the wings. These components are accurately aligned by a floor fixture in which the longeron is placed and which locates the lower ends of the bomb racks; the side panels are positioned from the bulkhead and wing section.

At Station number 4 the assembly reaches the second mating jig. Here the wing section is lowered by means of hydraulic rams on four center pillars which are identical to those used in the first mating fixture. The operation performed here is to mate the fuselage nose section and the wing center section. The fuselage nose is lowered by means of an overhead traveling crane and positioned by means of its locating straps on a specially designed truck. Made of heavy castings and mounted on one flat rail and one bevel rail, the track is laid level with points of contact of the fixture and has a heavy foundation to maintain this alignment. In this way the position of the fuselage nose section is held in proper relation to the wing in flight position. The truck has a special geared device to roll the fuselage back into mating position where it is drilled and riveted to the wing and canopy attachment points. The center wing section already carries prepunched holes around the mating surface which serve as a guide in drilling the fuselage rivet holes.

In order to support the front end of the fuselage nose section, a separate transfer truck is provided which runs on its own rails. When the wing is again lifted by the hydraulic rams in the end towers, a hydraulic jack in the small nose truck operates at the same time by means of a single set of automatically controlled valves. This keeps the assembly in level position so it can be pulled along by the conveyor while supported at the nose by the truck. The operation of the hydraulic jacks lifts the nose section out of the mating truck which is placed in position for the next assembly. After the second

mating jig, the assembly goes through three more stations where all hydraulic connections and wiring are installed and the riveting is completed. By doing as much work as possible outside the mating fixture the time cycle can be held to a minimum.

At Station 8 the assembly enters the third mating jig which is used for assemblying the fuselage tail section and the wing center section. Here the procedure followed is identical to that for mating the nose section. The wing is again lowered to the four pillars while the fuselage tail section is dropped into its own mating truck by means of an overhead crane. A twin crank mechanism rolls the section into line with the wing and nose sections where it is riveted into place. A special gage is used for checking the bomb door openings in order to make sure that the doors will fit properly.

In Station 8, the nose wheel assembly is installed by lifting it into position using a special jack. Then the entire assembly is raised again to the height of the conveyor track, and the landing gear wheels are lowered so that the plane can roll on its tricycle gear through the next four stations. It is pulled along by a draw bar which attaches to the nose wheel hub. The other end of the draw bar is connected to an endless chain conveyor below the floor level.

In Stations eight to twelve the trailing edges are installed, the wing flaps and empennage assemblies are added, and the engines are mounted. Engines have been previously prepared in a separate line. They are thoroughly cleaned and completely equipped with their oil tanks, oil coolers, intercoolers for the superchargers, and cowls. At the end of the preparation line, the engine is picked up by an overhead crane, lowered to a dolly and transferred endwise to the final assembly line.

At this point the four lines are reduced to two secondary final assembly lines. To effect the transfer the draw bars are disconnected and removed at Station 12, and the ships are pulled forward by means of wire cables pulled by winches. They are disconnected when the wheels have reached a floor level, lateral, slat conveyor which moves them into centered locations at the start of the secondary final assembly line. Platforms are provided at each station so the operators may reach all positions on the plane conveniently. There are twenty stations in one line and sixteen in the other. In these lines final installations are made and controls are checked.

At the end of the building, the planes roll on large turn-tables which turn them through ninety degrees. They are moved into the masking booths and then into an air-conditioned inclosed spray booths where the final camouflage paint coat is put on. Spray booths are shaped to the outline of the ship by means of inner partitions so the fume and excess paint may be removed with less movement of the air. The booths are illuminated with explosion-proof lighting fixtures.

On emerging from the spray booth each ship is entirely inspected and made ready for its flight test. It then enters a servicing chamber, separated from the rest of the plant, where oil and gasoline are loaded from overhead tanks by means of long hoses. Then the entire side wall of the chamber is lifted, and the bomber rolls out upon the flying field.

Center wing sections are carried by trolley brackets at their outer ends along a conveyor line. The assembly in the foreground is at the spray painting station

TIME-DATA SHEET NO. 36

Radial Drill Press Operations—I

PART:

Steel, brass, copper, cast iron, cast steel, alloy castings, micarta and fiber materials.

OPERATION:

Drill, ream, tap, counterbore, countersink, spotface and burr.

WORK STATION:

All 3-, 4-, 5- and 6-ft. radial drill presses in the East Pittsburgh Works of the Westinghouse Electric and Manufacturing Company.

CLASSIFICATION OF PARTS:

Very small part.....0 to 0.50 lb.
Small part.....0.51 to 5.00 lb.
Medium part.....5.10 to 20.0 lb.
Large part.....20.1 to 45.0 lb.
Very large part.....45.1 to 75.0 lb.
Jib crane lift.....75.1 to 2,000.0 lb.
Over-head crane lift.....Over 2,000.0 lb.

When the lift is particularly difficult, it may be necessary to use a jib crane lift on parts weighing less than 75 lb. Over-head crane lifts may also be used when jib crane lifts are specified, and in some cases for sizes ordinarily lifted by hand.

ALLOWED TIME FOR SET-UP:

Standard hours $= 0.1430 + 0.0900A + 0.0118B + C + 0.1460D + 0.0655E + 0.0270F + 0.0180G + 0.0065H + 0.1580J + 0.0455V_1 + 0.0520W_1$.

Where: A = Constant when tools must be secured from toolcrib.
B = Number of drills, taps, reamers or counterbores used.
$C = 0.0223$ = Constant per jig handled by hand.
$C = 0.0755$ = Constant per jig handled by jib crane.
$C = 0.1740$ = Constant per jig handled by over-head crane.
D = Number of angle plates per job.
E = Number of vises per job.
F = Constant for first clamp and bolt per job (with table set-up).
G = Number of additional clamps and bolts per job (with table set-up).
H = Number of parallels per job.
J = Number of times machine table is placed and removed.
V_1 = Number of times machine table is adjusted at an angle and returned.
W_1 = Number of slots in bedplate cleaned (when parts or jigs are clamped to bedplate).

ALLOWED TIME FOR EACH PIECE:

Each piece time is found by taking the sum of the necessary operations coming under one of the headings in the following tabulations. The regular formula expression has been omitted for simplicity. References are made to the following tables in determining each-piece allowances:

Table No. 1—Time to line up part on table.
Table No. 2—Time to drill cast steel.
Table No. 3—Time to drill cold rolled steel, or hot rolled steel, angles and plates.
Table No. 4—Time to drill bronze alloys.
Table No. 5—Time to drill copper.
Table No. 6—Time to drill brass alloys.
Table No. 7—Time to drill cast iron.
Table No. 8—Time to tap cast steel, cold rolled steel, and hot rolled steel parts.
Table No. 9—Time to tap bronze alloys.
Table No. 10—Time to tap copper.
Table No. 11—Time to tap brass and aluminum alloys.
Table No. 12—Time to tap cast iron.
Table No. 13—Time to tap with pipe taps, various metals.
Table No. 14—Time to ream various metals.
Table No. 15—Time to counterbore various metals.
Table No. 16—Time to countersink various metals.

ALLOWED TIME FOR EACH PIECE IN JIG:

Allowance Symbol	*Size of Part* Small	Medium	Large
Constant	0.0058	0.0097	0.0144
K	0.0105	0.0105	0.0105
L	0.0229	0.0229	0.0229
M	0.0047	0.0047	0.0047
N	0.0031	0.0031	0.0031
P	0.0019	0.0019	0.0019
Q	0.0025	0.0025	0.0025
R	0.0016	0.0016	0.0016
S	0.0050	0.0050	0.0050
T	0.0100	0.0100	0.0100
U	0.0011	0.0020	0.0027
V	0.0022	0.0022	0.0022
W	0.0010	0.0010	0.0010
X	0.0030	0.0030	0.0030
A_1	0.0033	0.0033	0.0033
B_1	0.0055	0.0055	0.0055
C_1	0.0013	0.0013	0.0013
D_1	0.0035	0.0035	0.0035
E_1	0.0048	0.0048	0.0048
F_1	0.0061	0.0061	0.0061
G_1	0.0121	0.0121	0.0121

(Add machining time allowances from Tables 2 to 16, inclusive.)

Allowance Symbol	*Very Large By Hand*	*Size of Part* Very Large Jib Crane	Very Large Over-Head Crane
Constant	0.0204	0.0790	0.1250
K	0.0105	0.0105	0.0105
L	0.0229	0.0229	0.0229
M	0.0047	0.0047	0.0047

Note: The term "allowed time" used in these and following data represents the time required by any worker to perform a given unit of work, using average skill, showing average effort, under average conditions, with average consistency, allowing for fatigue, personal needs and unavoidable delays. *It is the time within which the worker is expected to perform that work.* All times are given in decimal hours. Accurate conversions to minutes and seconds can be made by means of the following formulas: Decimal hours $\times$ 60 = decimal minutes; decimal hours $\times$ 3600 = decimal seconds. The data given represents standards developed for use at East Pittsburgh Works of Westinghouse Electric & Manufacturing Company for conditions of work existing in that plant when these standards were developed. Each allowance should be checked in the light of local conditions before being applied elsewhere.

MORE AND BETTER GAGE BLOCKS

to take the measure of the AXIS!

The chart above shows the "miracle of production" of Gage Blocks which is being achieved at the WEBBER "Home of Precision."

This record is not the result of a reckless over-night expansion but the consequence of a long, carefully-planned program designed to enable WEBBER to provide American Industry with constantly better WEBBER Gage Blocks—*in any quantities required!*

The "promise" is being beaten—we are supplying *better* WEBBER Gage Blocks—not only to our own industry but to virtually all of the United Nations—*in any quantities required!*

TO YOU AS A USER, WEBBER Gage Blocks provide the means of meeting the constantly growing demand for work to infinitely closer tolerances and reducing costs due to rejects.

If your work calls for limits of .001" or less, your plant should be equipped with at least one set of WEBBER Gage Blocks for use on each step of your operations from set-up to final inspection.
Write for complete information.

For the duration, WEBBER'S entire production facilities are being devoted to the manufacture of Grade A Blocks only.

Webber
GAGE COMPANY
12901 TRISKETT RD., CLEVELAND, OHIO

Prompt delivery on proper priority orders. Prices—Set No. 81A—$350.00. Set No. 40A—$185.00.

TIME-DATA SHEET NO. 37

Radial Drill Press Operations—II

Allowance Symbol	Size of Part: Very Large By Hand	Very Large Jib Crane	Very Large Over-Head Crane
N	0.0031	0.0042	0.0042
P	0.0019	0.0019	0.0019
Q	0.0025	0.0025	0.0025
R	0.0016	0.0016	0.0016
S	0.0050	0.0050	0.0050
T	0.0100	0.0100	0.0100
U	0.0042	0.0530	0.0530
V	0.0022	0.0022	0.0022
W	0.0010	0.0010	0.0010
X	0.0030	0.0030	0.0030
Y	.....	0.1010	0.1010
Z	.....	0.0285	0.0285
A_1	0.0033	0.0033	0.0033
B_1	0.0055	0.0055	0.0055
C_1	0.0013	0.0013	0.0013
D_1	0.0035	0.0035	0.0035
E_1	0.0048	0.0048	0.0048
F_1	0.0061	0.0061	0.0061
G_1	0.0121	0.0121	0.0121
H_1	.....	0.0415	0.0415
J_1	.....	0.0192	0.0192

(Add machining time allowances from Tables 2 to 16.)

Where: Constant = Allowance for handling part in jig.

K = Number of times chucks are put in and removed — use this allowance in each piece time only when it is necessary to change chucks. Otherwise, allow the value in the set-up allowance.

L = Number of times keyed chucks are put in and removed (drills over 1 7/8 in.) — use this allowance in each piece time only when it is necessary to change chucks. Otherwise, allow the value in the set-up allowance.

M = Number of times tools are put in chucks and removed.

N = Number of times arm is moved to hole or from hole to hole.

P = Number of tap holes lubricated with brush.

Q = Number of holes burred (includes move arm and locate).

R = Number of "blind" holes tapped (includes blow out chips).

S = Number of times machine dial is set for depth.

T = Number of times arm is raised and lowered on column.

U = Number of times jig is turned over.

V = Number of times jig bushing is placed and removed.

W = Number of times jig cover is opened and closed — when hinged.

X = Number of times jig cover is placed and removed — when not hinged.

Y = Number of times jig cover is placed and removed, and adjusted — using jib crane.

Z = Number of times conjunction part is placed and removed.

A_1 = Number of locating screws tightened by hand.

B_1 = Number of locating screws tightened with wrench.

C_1 = Number of thumb or wing nuts tightened.

D_1 = Number of hexagon or square nuts tightened with wrench.

E_1 = Number of locating pins inserted and removed.

F_1 = Number of clamps — already in place.

G_1 = Number of clamps — placed and removed complete.

H_1 = Number of times trunnion jig is turned 1/2 turn (90 deg.).

J_1 = Number of times trunnion jig is turned over (180 deg.).

ALLOWED TIME FOR EACH PIECE IN VISE:

Allowance Symbol	Size of Part: Small	Medium	Large
Constant	0.0093	0.0119	0.0149
K	0.0105	0.0105	0.0105
L	0.0229	0.0229	0.0229
M	0.0047	0.0047	0.0047
N	0.0031	0.0031	0.0031
P	0.0019	0.0019	0.0019
Q	0.0025	0.0025	0.0025
R	0.0016	0.0016	0.0016
S	0.0050	0.0050	0.0050
T	0.0100	0.0100	0.0100
K_1	0.0046	0.0046	0.0046
T_1	0.0042	0.0042	0.0042
U_1	0.0081	0.0093	0.0105

(Add machining time allowances from Tables 2 to 16.)

Where: Constant — Allowance for handling part in vise.

K = Number of times chucks are put in and removed — use this allowance in each piece time only when it is necessary to change chucks. Otherwise, allow the value in the set-up allowance.

L = Number of times keyed chucks are put in and removed (drills over 1 7/8 in.) — use this allowance only when it is necessary to change chucks. Otherwise, allow the value in the set-up allowance.

M = Number of times tools are put in chucks and removed.

N = Number of times arm is moved to hole or from hole to hole.

P = Number of tap holes lubricated with brush.

Q = Number of holes burred (includes move arm and locate).

R = Number of "blind" holes tapped (includes blow out chips).

S = Number of times machine dial is set for depth.

T = Number of times arm is raised and lowered on column.

K_1 = Number of holes spot drilled from layout (move to hole or from hole to hole.)

T_1 = Number of times part is lined up with scale or level.

U_1 = Number of times part is turned in vise.

ALLOWED TIME FOR EACH PIECE ON TABLE:

Allowance Symbol	Size of Part: Small	Medium	Large
Constant	0.0058	0.0084	0.0110
K	0.0105	0.0105	0.0105
L	0.0229	0.0229	0.0229
M	0.0047	0.0047	0.0047
N	0.0031	0.0031	0.0031
P	0.0019	0.0019	0.0019
Q	0.0025	0.0025	0.0025
R	0.0016	0.0016	0.0016
S	0.0050	0.0050	0.0050
T	0.0100	0.0100	0.0100
K_1	0.0046	0.0046	0.0046
F_1	0.0061	0.0061	0.0061
G_1	0.0121	0.0121	0.0121
L_1	0.0010	0.0020	0.0032
M_1	0.0585	0.0585	0.0585
N_1	0.0043	0.0043	0.0043
P_1	0.0084	0.0084	0.0084
Q_1	0.0022	0.0022	0.0022
R_1	0.0455	0.0455	0.0455
S_1	Table 1	Table 1	Table 1

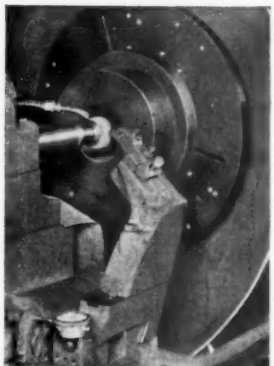
(Add machining time allowances from Tables 2 to 16.)

(To be continued)

Resourceful is the Word...

. . . for American industry in war-time. It's also a good one-word description of the Lempco AC Universal Wet Grinder. For it does almost any grinding and turning job within its capacity range—does them fast—accurately—fool-proof! 30″ swing; 7″ cross-slide travel; 16″ carriage travel; grinds holes to 7½″ deep. Internal, external, face, straight, or taper finish grinds, or rough turns! Uses scroll or magnetic chuck, or face plate. Rapid set-up. Hand-scraped, dove-tailed ways, with adjustable tapered gibs. Quick-change 80 or 130 RPM work speeds; variable quill speeds.

LARGER GRINDER WITH 53″ SWING AVAILABLE



AUTO-SIZER

Duplicates size of successive pieces mechanically! Fool-proofs production runs! Simple, accurate, exclusive!

LEMPCO

PRODUCTS · INC.

BEDFORD · OHIO · U·S·A

ESTABLISHED 1919

SEE ONE WORK – MAIL THIS COUPON

LEMPCO PRODUCTS, INC., Dept. AM, Bedford, Ohio

GENTLEMEN: Tell me the plant or shop nearest my place of business where I may see an AC Wet Grinder

Name .....

Address .....

City ..... State .....

Wanted—"Seed Money"

PERHAPS YOU ARE familiar with the term "seed money." It means to the farmer the money with which to buy seed before he can plant crops to grow food and other necessities. No seed money, no crops.

Businesses are in the same fix as the farmer. Their need for seed money is as great as his. If they are to design, develop and manufacture goods, they must have money to finance the project.

Aside from their initial investment and borrowings, their seed money must come from profits which can be reinvested in new machines, new methods and new products. By that means a market will be found for their goods and they will be able to employ a maximum number of people.

The problem of seed money is especially acute in feast-and-famine industries, such as machine tools.

Only one way is open, short of outright government subsidy, to keep the machine tool industry going through lean years as well as fat years. That is the obvious method of storing away some of the bounty in good times to provide for the bad times.

What would have happened if that method had not worked back in the twenties? Machine tool building as an industry would have been wiped out during the black years of the thirties (it came close to being wiped out as it was). And where would we have been when we suddenly awoke in the summer of 1940 to our perilous and almost defenseless position as a nation?

The answer is that we would have been completely sunk. Upon an adequate supply of machine tools rests our industrial structure, and more particularly our munitions and war goods industries. Without the hundreds of thousands of the world's finest machine tools that we were able to pour out of machine tool builders' plants on relatively short notice, our unpreparedness would have lasted long enough to have brought disaster upon ourselves and upon our allies.

While machine tool builders have been working day and night providing machine tools for the arsenal of democracy, they have deliberately and consciously been manufacturing trouble for themselves after the war. Available figures show that in the four years 1939 to 1942 inclusive, the industry produced more machine tools than in the preceding forty years.

The country will possess more good machine tools at the end of the war than it possibly will know what to do with. The post-war job of the machine tool builder to keep his plant and men busy is going to be terrific.

What is all of this leading up to? Just this: in the renegotiation of war contracts we hope that government officials will bear in mind the facts just recited. Machine tool builders are not making bombs and shell and guns which will cease to be used at the war's end. Their wartime products, in the main, will be adaptable to peacetime requirements.

These are the people who will be in special need of seed money. They will be eager to develop new machines of the latest type and to try to provide as nearly as possible the full employment that all of us want.

To do that, however, they must be permitted to retain a sufficiently liberal share of their current net profits to have the necessary seed money for post-war readjustment.

Burnham Finney

GAGING BUSINESS

Heavy machine tool production credited with huge, quick output of war goods. Machine tool production is again upward. Some are delivered faster than aircraft industry can use them. Our allies want more tools

Machine Tools Set New Record Production of machine tools for war plants in the United States and in other United Nations this year is likely to be within ten percent of the all-time peak attained during 1942. Output last year is unofficially estimated at $1,350,000,000, compared with $775,000,000 in 1941, the previous high.

More machine tools have been built in the four years of 1939 through 1942 than in the previous 40 years. That is one of the chief reasons that America has been able to get into huge production of war goods so quickly. December was the biggest month of 1942 for machine tool shipments. Output then exceeded $130,000,000. Shipments in January are reported to have declined from the December level. Because of the short month, February probably will not be much better than January. An upward turn is looked for in March.

Tool Shifting Softens Rise New machine tool bookings are on the upgrade, after having moved downward for some time. Cancellations of old orders, on the other hand, are relatively heavy and partly nullify what otherwise would be considered important gains. The policy just put into force, whereby the Army and Navy have delegated authority to the tools division of the War Production Board to remove idle machines from one company and install them in another which badly needs them for war work, may accentuate cancellations in the next month or two. It is believed that roughly 40,000 machine tools may be uncovered and put to work.

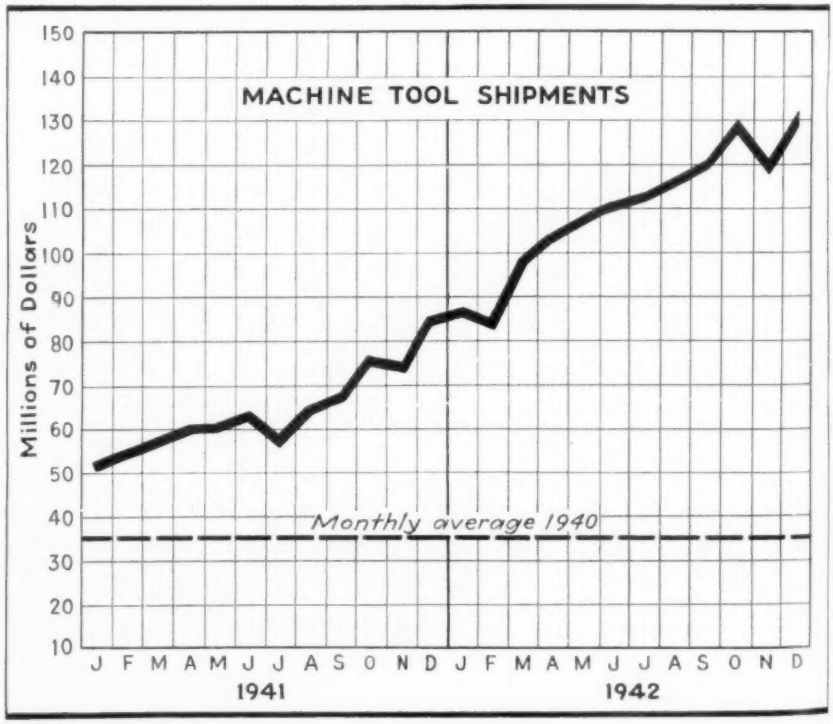
Tools Delivery Reported Fast Machine tools to complete expansion of aircraft production facilities are being built at such a fast rate that some aircraft factories cannot put the machines to use immediately upon receiving them. No modification is expected, however, in the presidential directive giving the aircraft program first call on the country's machine tools. Application of this directive already has resulted in an abnormally high number of diversions of machines from contractors for whom they originally had been earmarked to other companies.

Both Russia and Britain are seeking large quantities of machine tools for delivery in the next six months. It appears doubtful whether they will be allotted all that they want because of requirements for filling out our own war production program. Later in the year machine tool output will taper, particularly in the last six months. New war demands, which will arise as military and naval operations expand, will call for sizable numbers of machine tools that will keep the machine tool industry running far ahead of its peacetime volume throughout the war.

Spring Will See Production Peak Peak war production, including construction, will come late this spring. After that, the total is expected to drop onto a high plateau. The elevation at which output will be stabilized depends on many as yet indeterminable factors. When this plateau is reached, however, war expenditures will be more than the country's 1929 national income and will stay there for the duration.

The building of new war factories is falling off rapidly. Few new war plants will be undertaken. Many projects now in progress are likely to be stopped. The stoppages of ordnance production already announced are only a fraction of the amounts that are privately estimated to have been held up. Lopping off of future deliveries in some lines has not appeared in the published figures.

Raw Materials Are The Problem Pressure on the country's raw materials supply will not be importantly relieved by these shifts in war production. The huge expansion in the goals for output of aircraft, escort vessels, merchant ships and other war items will require far more materials than have been used in the programs now approaching their end or nearing extensive curtailment. Terrific heat is being put on the program to secure more escort vessels, which seem to provide the solution to the alarmingly high ship sinkings by submarines. Current production of escort vessels is only a fraction of what it will be a few months from now. Low spots in aircraft manufacture, such as aluminum extrusions and forgings, are being eliminated as rapidly as possible.



Homestretch Spurt—As 1942 waned, machine tool shipments sagged during November and then spurted to a new high in December. The twelfth month total was $131,900,000, as compared to $120,900,000 in November, or a rise of 9.1 percent. As shipments continue to rise and new orders continue to dwindle, the backlog of unfilled orders is being gradually whittled away

WPB Is Readily Altered to Accommodate Changing Need

As the problems of war material production change, so shift the set-up and activities of WPB. Standardization of designs by purchasing agencies is expected

BY ROBERT COLBORN

WASHINGTON—The War Production Board is a sort of chameleon. Its structure and duties shift constantly with the constant shift in production problems. Only a few months ago its staff was entirely reorganized around the material distribution job and so many of its production duties were sloughed off that the continued existence of a production vice chairman seemed rather superfluous. Now production bottlenecks are coming to the fore once more, and the production staff in WPB is gaining bulk and authority.

The overwhelming recognition last summer that the business of manufacturing munitions had been substantially licked and that the supply of basic raw materials was going to set the limit on over-all war production, and the chaos into which the priority rating system had fallen—all resulted in WPB concentration on the priority problem. Ferdinand Eberstadt brought forward his Controlled Materials Plan, and almost the entire WPB was revamped into a material-distributing shop.

Saw Production Problem

Even at that time, however, it was realized that there was another problem, a production problem, that had to be licked. Not in the munitions factories, which were going great guns, but in the plants producing parts, fittings, forgings, castings—components. It was shortages of these, rather than of ingot, which was causing the immediate factory slowdowns (*AM*, Aug. 20, p. 916c).

The solution of this problem is the most urgent of those facing Wilson. Rubber, high-test, and escort vessels are the top priority jobs for this year. And all of them are being bogged down by their reciprocal competition for valves, heat exchangers, gears, blowers, forgings, crankshafts, etc. Wilson and the services have prepared a list of 34 such items which are used by several agencies and for which the demand exceeds the supply.

Standardization is Seen

Wilson has assigned his scheduling aide, Ralph J. Cordiner, the job of stepping up the production of these items and distributing them equitably among the competing programs. A quick survey of the demand for the 34 items has already revealed a lot of room for standardization. Different agencies and different bureaus of the same agency are ordering items which are substantially identical but with hundreds of little differences that are just big enough to futz up production. Wherever production of these critical items is being held up by material shortages, Cordiner is arranging with the Requirements Committee for approval of AAA ratings on their needs. Idea is to feed as much material into these critical plants as they can handle. The total quantities are small and they are causing delays that bulk large.

In some cases, existing facilities will be converted to the manufacture of these critical items. Construction of new facilities is not being considered.

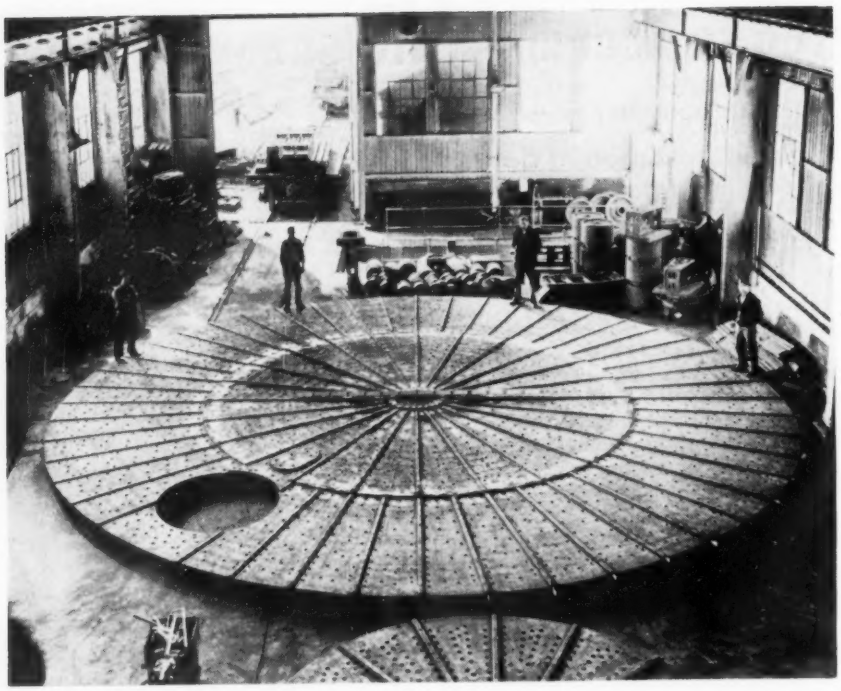
Johnson's Appointment Will Bring Use of Small Plants

WASHINGTON—War production officials, by and large, long ago came to the conclusion that, in war there isn't much that can be done for the little fellow; when production is what you want, you have to lean on the big boys. But appointment of Col. Robert Johnson as new head of the Smaller War Plants Corp. indicates that what can be done will be done. Interpretation of the appointment as a take over by the Army is incorrect. Col. Johnson is an unusual ordnance officer. He was Donald Nelson's first choice for the job when SWPC was created. He has had disagreements with ordnance highups because, when he headed the New York Ordnance District, they earmarked proposed contracts so that it was difficult for him to spread them around. Even so, he set up a small plants section at New York and was able to give about 32 percent of his contracts to plants employing less than 50 men.

Machine Tool Deliveries Frozen for Sixty Days

WASHINGTON—The War Production Board has amended E-1-b so as to freeze machine tool producers delivery schedules for a period of 60 days, during which the schedules cannot be modified by receipt of higher rated orders. The freeze period is progressive, in that the schedule, as of any given day, must stay as is for 60 days, regardless of higher ratings that may come in. It applies to the aircraft program, as to all other categories. The order is effective as of the date of issue, January 26.

Speeds Inspection—Production of an acorn-sized commutator for aircraft radio sets has been stepped up 20 percent and cost cut a tenth by use of the comparator by Westinghouse Electric and Manufacturing Co. inspectors. An image of the commutator's surface, magnified 22 times, reflects on a glass screen



Meehanite Monster—Ninety heat resistant castings of Meehanite metal make up this 41 ft. diameter distributor plate manufactured by the American Brake Shoe & Foundry Co. It will be installed in the largest vessel for pressure operation yet designed. Record of this type unit, only a few months ago, was 21 ft.

V. Chairman Wilson Handles Industry, Agency Schedules

WASHINGTON—WPB Production Vice-Chairman Charles E. Wilson is taking on two major jobs, in connection with the Controlled Materials Plan. The CMP throws the responsibility for scheduling production of Class B items onto the WPB industry divisions, now under Eberstadt's jurisdiction. Wilson, however, is taking on the job of setting up scheduling units in the divisions, bringing in men with production experience in industry. The divisions appear now to be gravitating toward Wilson's corner of the shop.

The other job is overseeing the internal scheduling done by Army, Navy and the other claimant agencies. Arrangements are being worked out by which all production schedules will clear through Wilson's office before going to the Requirements Committee. He will check on their feasibility from the production point of view—adding up the demand for various components to ensure that they don't exceed productive capacity—before the Requirements Committee studies feasibility in the light of material supply.

Wilson is now devoting a considerable share of his time to a sort of consulting service on Army and Navy scheduling, aimed particularly at seeing that the different bureaus and services break down their schedules in the same units so as to make them comparable.

Farm Machinery Industry Steel Allotment Up a Third

WASHINGTON—WPB's Requirements Committee, yielding quickly to demands by the Truman Committee investigating the war program, added 50,000 tons of Bessemer steel to the 137,000 tons allotted to the farm machinery industry for the first quarter. The allotment of 120,000 tons for the fourth quarter of 1942 had been increased to 178,000 tons, and the industry had been given a rating of AA-1, equal to the highest military priority. Donald Nelson at once agreed with the Committee that the farm machinery steel quota ought to be raised, but he dissented with any criticism of the Office of Civilian Supply, which had not initiated the request for the increase. He said that the program of OCS was perfectly sound in the light of facts as they were when plans were drawn.

Fear of Inflation Helped Kill Nugent Pre-Pay Plan

WASHINGTON—The Nugent Plan of installment selling in reverse—pay now for goods to be delivered after the war—is just about dead. A burst of publicity early last month started the short life of the plan. It called for the issuance of special Treasury bonds not redeemable until after the war. They were supposed to be earmarked for the purchase of particular goods—a car, a refrigerator, etc.—after the war, and the purchaser would be given a priority on the first of the peacetime goods produced. Hope was that the plan would serve the double function of creating a post-war reservoir of purchasing power and of draining off money now to prevent inflation. Regular dealer organizations would merchandise the bonds.

The plan got some support, but the people most immediately affected, the dealers, are cold to it. They fear the ill will that would be created if inflation ran the prices way above what the buyer expected, and they fear equally the resulting probability of post-war price controls. And anyway they don't want the government monkeying in their business after the war.

Recent Material Contracts Based on Costs Knowledge

WASHINGTON—Basic reason why the Army and Navy have been able to recapture large sums—something like a billion and a half so far—by renegotiation of war contracts is that until recently no one knew what it cost to make war goods. When contracts were let, the prices were largely guesswork and it often proved that the guess had been too high. Nowadays, industry has a pretty good idea of munitions costs and renegotiation of recent and future contracts isn't likely to locate a great deal of gravy. The War Department is recognizing this situation in two ways. Firms which have been through the renegotiation mill can obtain a guarantee against renegotiation of future business on the same items, provided that business is priced in the light of facts disclosed by the renegotiation already done. A procedure is also being set up by which long-term contracts will contain a provision for readjustment of the prices every three to six months. Such contracts will not be renegotiated.

Pamphlet Describes Alien Patents Offered Industry

WASHINGTON — American industry may obtain the use of the approximately 50,000 patents, formerly owned by residents of enemy and enemy-occupied countries, and now held by the U. S. Alien Property Custodian.

"The inventions disclosed in these patents represent research achievements of great potential value. They will have high usefulness as a means toward winning the war and as a contribution toward rebuilding our peacetime economy," states an announcement from the office of the Alien Property Custodian. "The success of this program will depend largely on how rapidly and effectively American business utilizes the inventions covered by these patents for increased and improved production."

INSIDE DETROIT

BY RUPERT LE GRAND

Captain Rickenbacker attacks labor, stirs hornet's nest; Murray, Thomas say he misunderstands. General Rose estimates '43 needs at 6,700,000 workers. Voluntary "manpower freeze" cuts labor turnover

First all Was Smooth Going Just when it seemed that the tough attitude of the Army and the just as tough attitude of the union leaders would calm the turbulent labor situation here, Capt. Eddie Rickenbacker stirred up a new hornet's nest that threatens to nullify all the inspirational good that the World War I ace did among the individual workers at the plants.

Rickenbacker toured five plants in one day, quite a task in itself. He made short speeches at three, getting rousing cheers with his pleas to "turn out more and more" for the boys on the fighting fronts. At Ford Willow Run he inscribed one bomber in semi-completion with "The boys at Guadalcanal need this plane—the sooner the better." A completed bomber was dedicated to him.

Sought to Cut Absenteeism At Cadillac he formed a section of his "Hats in the Ring" Squadron for workers who had not been absent from work for 21 days or more. It was all good for workers' morale and it seemed that Rickenbacker's visit would show its worth in added production and less absenteeism.

But Then Came the Fireworks The same night, however, the famed flier spoke before the Detroit section of the Society of Automotive Engineers. He got off well with a recital of his 21 days in the Pacific before being rescued. Then he told of his trips to New Guinea, Australia and Guadalcanal. Came his bombshell, an attack on the New Deal policies and unions' demands for double time, overtime and the eight hour day. By implication, he labeled the unions responsible for all the ills of production, for the lack of arms and material.

The boys at the fronts are doing too much with too little, he stated. And the people on the home front were responsible for too little too late, his remarks indicated. He advocated a three point program for Congressional legislation: To give the soldiers jobs without regard to closed shops agreements; to give them a voice in employe-employer agreements without a union card as a pre-requisite; seniority as of the date of enlistment or induction.

It Didn't Take Long The repercussions to his speech were not long in being felt. His audience, composed mainly of industrial tycoons, officials, business men and executives, reacted favorably, cheered his stand on labor's responsibilities and the New Deal's shortcomings.

But union leaders and the rank and file are up in arms. His remarks were timed with the visit to Detroit of Philip Murray, CIO chief. Murray was mild but specific: Rickenbacker was either misinformed or he had misunderstood what labor had done in the war effort.

"I ask the Lord to forgive him for he knows not what he does," Murray concluded piously.

R. J. Thomas, president of the UAW, was not quite as mild but just as critical.

"The hero was certainly misinformed," stated Thomas. "The Society of Automotive Engineers can have its Captain Rickenbacker."

Murray followed his remarks on Rickenbacker with some sage advice to employers.

"They must discontinue their hesitant attitude toward labor," he said. "They must stop pushing labor away from them."

Blames Bosses for Wildcats He charged one of the chief causes of wildcat strikes, which have beset Detroit again after a short period of quiet, is that management has refused to bargain honestly with labor since "labor has given up its economic gun, the right to strike."

The establishment of a War Labor Board office in Detroit may help matters here. Before, all disputes had to go to the Cleveland regional office which complained it was understaffed to handle the volume of complaints quickly.

Need 6,700,000 More Workers Brig. Gen. William C. Rose, head of the manning division of the War Production Board, told the National Screw Machine Products Association that the nation would add 2,500,000 war workers to the present total of 17,500,000 in 1943. In addition, he said the Army will take 4,200,000 of the choice physical and age classifications from industry this year.

Despite the facts that on his figures, industry will have to obtain 6,700,000 additional workers during the year, General Rose said he saw no reason for mandatory manning tables except in critical labor areas.

Says Manpower Freeze Works Despite widespread criticism of the voluntary "manpower freeze" in the Detroit area, Montague C. Clark, head of the War Manpower

Roll Reducer — Final inspection of an intricate Sperry gyro-compass produced at the Dodge Division of Chrysler Corp. Finer than a watch with parts more delicate and thinner than a human hair, these gyro compasses are used to stabilize sub-chasers, net tenders and other naval craft

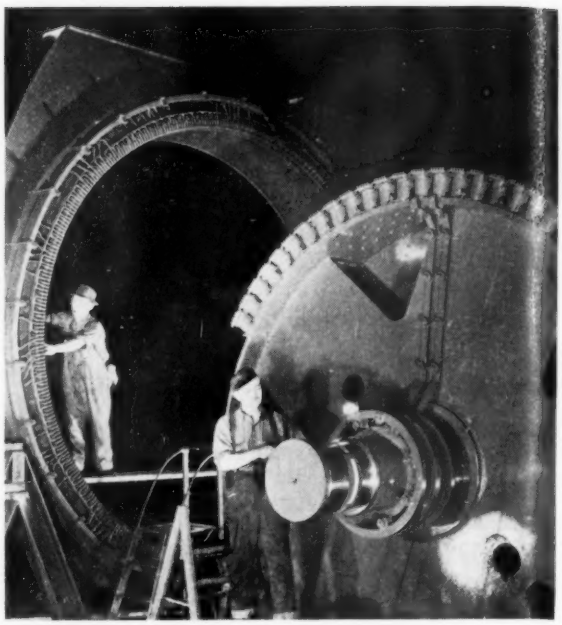
Commission here, insists that it is working. He cited the fact that only 3,000 applications were filed for releases in the first month of the freeze.

Of this number, 1,800 were referred back to their employers for further conference and never came back for their releases. Clark points out that normal turnover in the plants in this area is about 6 percent and an enormous reduction has been effected by the new policy.

Workers Must Get Permission Those seeking transfers must confer first with their employers and the union to which they belong and must get the consent of both in order to obtain a transfer. Unions seem to be cooperating as well as employers in holding down transfers. This may be due to the fact that the locals do not like to lose a revenue-paying member to some other local.

Big Employers Avoid USES The large companies are still fighting shy of the U. S. Employment Service as an aid in filling their labor needs. They claim they have enough applications at their own employment offices. Chrysler claims 2,000 a week seek jobs with them; General Motors puts their applications at about 4,000 and Packard has 1,500 come to them for work.

Another reason for larger companies staying away from the USES is that they fear that governmental agency is trying to fill them up with colored workers. A high GM official recently said that the voluntary registration of women for work was part of the desire to "see that we get our share of the colored women in our plants."



Tanker Motor Rotor — Workman puts finishing touches on rotor shaft while inspector checks insulation of the stationary part of the motor. Assembled and installed in one of the U. S. Maritime Commission's new 21,000 ton oil tankers, it will develop 6,600 h.p. Westinghouse has built twelve, is constructing 28 more. The rotor stands 13 ft. high and weighs 30 tons

WAR RULINGS IN BRIEF

Checklist of Significant Regulations on Materials and Prices

BISMUTH—No person may deliver, accept delivery of, or use any metallic bismuth without specific authorization. (Conservation Order M-276.)

CHROMIUM—To eliminate paper work producers of this material are no longer required to file Form PD-54 with suppliers, but only with WPB.

CONSTRUCTION MACHINERY — Use of alloy steel in angledozers or trailbuilders, in bulldozers and repair parts for both is prohibited. (Limitation Order L-217, Schedules III and IV.)

FIRE EXTINGUISHERS—Quota restrictions on the manufacture of certain types made of steel have been removed, and at the same time the order imposes new controls on certain products where no controls were formerly exercised. (Amendment to Limitation Order L-39.)

FARM MACHINERY—Several restrictions on the manufacture and distribution of this machinery and equipment have been modified, among which is the elimination of necessity for filing a "Certificate for Emergency Order" to obtain repair parts. (Amendment to Limitation Order L-170.)

FLUORSPAR—Shipments by producers to users of metallurgical and ceramic grade fluorspar is now controlled by WPB. Producers and shippers are forbidden to ship this material to persons appearing on restricted shipping lists sent to producers each month by WPB. (Regulation 1.)

MAGNESIUM SCRAP—Specific dollars and cents maximum prices for remelt magnesium and magnesium scrap has been established in a new regulation designed to supplement a recent WPB order which required segregation of such scrap. (Maximum Price Regulation 302.)

OFFICE SUPPLIES—Production, including desk pencil sharpeners and metallic file fasteners, has been ordered stopped. (Limitation Order L-73.)

PRESSURE GAGES — Manufacturers of industrial thermometers, pressure gages, control valves and other industrial types of instruments are required to file machinery reports showing their productive capacity, requested future deliveries and previous month's production. (Order L-234.)

PRINTING MACHINERY—This equipment may be produced only for the armed forces outside of the continental limits of the United States or on shipboard. (Limitation Order L-226.)

REPAIR & MAINTENANCE—Producers of iron and steel have been granted the use of the preference rating AA-1 for the acquisition of such materials. (Amendment to Order P-68.)

STEEL SCRAP—Copper-clad steel scrap has been brought under full allocation control. The order also sets up special procedure for disposal of fired shell cases made of copper, copper-base alloy, or copper-clad steel is amounts of ten lb. or more. (Order M-9-b.)

Subcontracting Is the Big Hope Subcontracting holds out the only hope for greater production of aircraft this year, according to a well informed Army officer, Maj. Nathaniel F. Silsbee of the Air Research Unit of the War Intelligence Division. Major Silsbee points out that subcontracting has gone from 10-15 percent to 40-60 percent so far and will go higher.

He pointed to the pooled production of bombers on the West Coast as a prime example.

Plenty of Manpower, but Personnel Policies Faulty

BALTIMORE—A cross-section survey of the manpower situation here reveals an adequate supply of local labor but a training and placement program inadequate for the needs of a total war effort. Such are the major conclusions of "Where Can We Get War Workers?" by Sanford Griffith, published by the Public Affairs Committee, New York.

Although Baltimore needed approximately 59,000 new workers in the last five months of 1942, of which about 32,000 were expected to come from outside the city, there actually were more than 300,000 potential workers within the city who were not being utilized. Some 250,000 of these were women, and a large part of the remainder were Negroes. Though employment of each has risen, "there is still considerable doubt whether either of these groups is being trained and placed in jobs as rapidly as is needed for an all-out war program," according to the survey.

WARTIME WASHINGTON

BY BLAINE STUBBLEFIELD

While renegotiation of war contracts may hurt some contractors and may even bankrupt others, administrators are trying to be as fair as possible. Agitation is resumed for return of profit limiting law. Lendlease is analyzed

Renegotiation May Hurt Some Renegotiation of war contracts is not really negotiation. It is price adjustment, as the name of the administrative agency—War Department Price Adjustment Board—implies. The administrators, when you see them in person, are fair-minded, intelligent business men. Some of them are even Republicans, if that is any comfort to you. But while they listen sympathetically to, and actually accept most facts (no opinions) bearing on cases before them, nevertheless they exercise unlimited executive power to dictate terms.

The board considers every possible factor in making its determinations—quality of product, promptness of delivery, comparative cost, invention and new processes, problems of conversion to war products, possibility of cancellations of their orders, capital tied up, extent of government financing.

The Board Hews to the Line The board is exercising great arbitrary power and does not deny it. It does not pretend to guarantee any business against damage as a result of its decisions. Obviously, among all the firms that will go bust as a result of the war, will be some which the board has scaled down as too prosperous. For instance, some producers whose profits are being adjusted downward, more than likely will be caught by the war's end with inventories marketable only at less than cost, and will lose more than they have earned in war business. To such suggestions, the administrators can only reply that no kind of power or justice can give soldiers any assurance against loss of legs, eyes or lives.

Adjustments Are Usually Fair It seems probable that most producers subjected to profit adjustment are not unfairly hit. In many cases, their large profits result from the circumstances of the war, not from their own efficiency. Even if large profits result from skillful management, most heads of businesses do not wish to take wealth or even security for the future, from the misfortune of war. Some few so wish. In either case, the board's intention is to reward efficiency in reasonable measure. To that extent, the war price adjustment law is claimed to be a production incentive scheme.

Reports indicate that almost everybody in the metal working industries (as in other industries) is afraid of renegotiation. The administrators say that nobody fears it except those who have not gone through it. This may be true, but some people who have been adjusted downward are pretty mad about it.

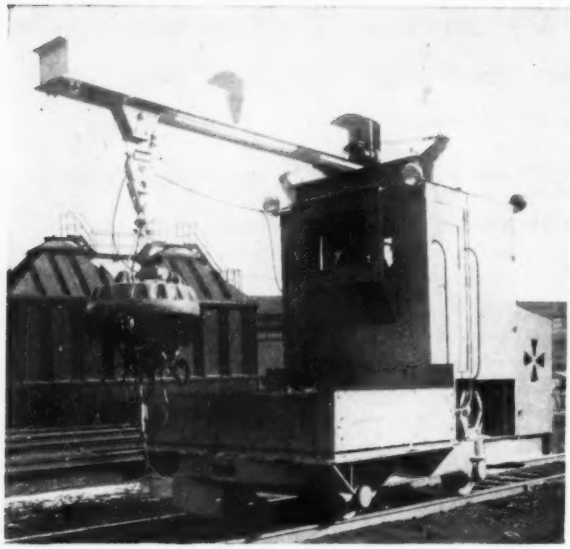
Fishy Eye Cast at Lendlease As people feel the first real pinch of war privation, losing their galavanting gasoline, their butter and their shirt tails, they turn the inquiring eye on lend-lease, which is sending mountains of stuff to "foreigners." There are still a few scattering isolationists in Congress who, as the question of extending the lendlease law comes up for action, are agitating just enough to make the administration put out a strong sales talk on the principles of "defense aid" which is another word for it. Actually, both the congressional and public support of the lend-lease program is heavy.

This sales talk showed up along with a report by Lend-lease Administrator Edward L. Stettinius, covering the whole period of the act to promote the defense of the United States, March 11, 1941 to December 31, 1942. The report and the argument go into great detail, but the sum of it is: That lend-lease aid for the period totaled $8,253,000,000; that meanwhile our allies had bought from us with their own funds almost as much goods as we had given them, or $6,900,000,000 worth; that it is to our advantage to give food and guns to other people who will kill part of our enemies for us.

Lendlease is Mostly Give When the President thought up the lend-lease plan, cruising on a ship at sea, he must have thought of it realistically as a cost of our keeping out of the war, or of waging it if we got in. "Lend-lease" was a political euphemism invented to sell it to Congress and the public. There is in fact a great deal of lending, and a little leasing, of ships and the like, but most of it is straight giving, and "defense aid" is nearest to the right description. But, as the report points out, a great deal of the same is coming our way in the use of bases, ships, airplanes, and food supplies, in countries where our forces are fighting. Ordnance, ammunition, aircraft and parts, tanks and parts, motor vehicles, were all exported in large volume. Machinery, which includes machine tools, totals $281 million; the bulk went to England and Russia.

New WPB Executives—Curtis E. Calder has been appointed director general for operations, to succeed Ernest Kanzler, resigned. Col. Robert Johnson, U. S. A. Ordnance, is the new head of the Small Contractors Division. Charles R. Fay, Westinghouse executive, is now on leave of absence to help develop plans and procedures required in administering CMP

Urge Profit Limiting Law Carl Vinson and others on the hill are agitating again for reinstatement of the over-all profit limiting law, which was suspended before the United States entered the war. Re-activation of this law of course would mean suspension of the present price limitation program.



Fast Picker—A self-powered magnetic scrap picker, designed and constructed by The Timken Roller Bearing Co. from odds and ends, is, in two hours, doing the work formerly done by three two-men crews in 24 hours. An ingot buggy, a diesel engine, a 230 volt d.c. generator and a 39 in. magnet are its major parts

Canadian Steel Workers Win Concessions by Striking Against Governmental Regulation

OTTAWA—Puncturing by the government of Canada's wage ceiling in order to establish a wage floor for Canadian steel workers worries the management of Canadian war industry, being interpreted as an invitation to labor organizations for a general assault on frozen wage rates. Puncturing of the ceiling was permitted by Prime Minister King's government for the purpose of ending the two weeks illegal strike of 13,500 steel workers at Algoma, Ontario, and in Nova Scotia. The compromise settlement proposed by Ottawa and accepted by the strikers assures unskilled workers in the Dominion's steel mills of a wage floor of 55 cents an hour which cannot be affected by any lowering of the cost of living index and which can extend into the post-war period. Industry fears that the concession will encourage warring labor unions to further assault on the wage ceiling and jeopardize wage stability.

Strike Against Government

The strike was admittedly against the government and the wage-freezing law rather than against the steel companies. Labor boards had rejected demands of C.I.O. unions for wage rate increases which would have benefitted all classifications of steel workers on the ground that they were barred by the wage ceiling law which permitted increases only for the purpose of adjusting out-of-line rates. The steel operators took no part in the dispute. When a special commission appointed by Ottawa confirmed the decision of the labor boards the strike was called in defiance of wartime regulations governing the holding of strikes. About two-thirds of Canada's primary steel capacity was tied up for two weeks.

The compromise settlement negotiated by Canadian and United States heads of United Steel Workers of America allows the 55 cents base rate to unskilled workers but withholds increases from those in higher classifications. Local unions at Algoma accepted the settlement unconditionally, a minor union in Nova Scotia rejected it entirely, while the principal unions at Dominion Steel and Coal Company in the eastern province agreed to return to work with a threat of another strike in thirty days if original demands were not granted.

Industry Has Expanded

Canada's primary steel industry has practically doubled its capacity since the war started and is now supplying about two-thirds of the country's requirements. Expansion has been in blast furnaces, open-hearth and electric furnaces and coke ovens rather than in rolling mills. A large new plate mill came into production at Hamilton about a year ago and a new blooming mill was established at Sault St. Marie. Considerable expansion has taken place in Nova Scotia. There has been a threefold increase in employment in the industry since the war started.

Iron and steel products industries are now employing close to half a million people and their weekly payrolls of over 15 million dollars amount to almost half the total of Canada's manufacturing payrolls.

After War, What?

The fate of the expanded primary steel industry of the Dominion after the war is considered speculative, in view of the trend towards continental rationalization of production. The industry developed under tariff protection and has been an important factor in Canadian employment and in export trade during peace time, becoming a major factor in the country's effort in both world wars. But tentative discussions of possible post-war developments have questioned the relative advantages of continuing to support Canadian primary steel production by tariff protection as against a saw-off by which Canada would open its domestic market for heavy steel in exchange for a U.S. market for special steels and other metals in the production of which the Dominion's large power resources would be a factor.

All Women—In an all-women department of the Lodge & Shipley Machine Tool Co., small lathes are completely assembled and tested by a group previously trained in the regular assembly department. All operations, from scraping of the bed to final testing and run-off are performed

THE AIRCRAFT HORIZON

Allies have produced a lot of planes, but wide dispersion spreads them thin. Improvement in high test gas production will give us far more than we'd expected; will alter plane and auto design. Standing aviation committee advocated. Aeronautical C. of C. is chastised.

Warplanes to Russia total 4,600, says Edward R. Stettinius in his Lendlease report. From the United States came 2,600 of these, and the other 2,000 from England. Roughly adding up, which you could do for yourself if you watch aviation, United Nations have produced something more than 150,000 airplanes in the last couple of years. Upon casual thought, one wonders what has become of all these planes. You read about missions of 50 here and a hundred there, and sweeps of mere hundreds over Europe. Of course the answer is that the Allies' planes are scattered at scores of stations, and that it takes a lot of planes undergoing service and overhaul to keep a certain proportion of them in the air. Airplane swapping would drive a bookkeeper crazy. England has received an untold number of planes from the United States, yet England is sending planes to Russia, at the same time trying to get more and more from us.

High test gasoline is about to play an important role in automobile and airplane engine design. Standard Oil of New Jersey has just brought in its third catalytic cracking plant. Its total program is five plants, and the industry has programmed 25 others. The main thing is that we and our allies will have quantities of aviation gasoline far above our earlier expectations. Censorship forbids any public mention of octanes higher than 100, even though several publications have called attention to surprisingly high ratings already achieved. When super-high test fuel is in use, it will require considerable re-design of aircraft engines to take care of the increased head pressures, and the increased horsepower output. At a recent press inspection of the S. O. New Jersey "cat cracker," auto men said that high octane fuel would result in very small automobile motors, permitting radical changes in car design.

Lockheed's Constellation, four-engined transport plane, has been flown after several years of development work under the supervision of Howard Hughes, of the Hughes Tool Company. Two fleets of these planes were under contract a couple of years ago, to Pan American and Transcontinental and Western Air, but Army took over the orders, allowing the development to continue. The C-69, as Army tags it, has all the modern attachments: 'hot wing' de-icer, manuevering flaps, passage-way in the wing to all engines, hydraulic boosters on all controls. It has nearly twice the speed of current airline equipment, a ceiling of more than 35,000 feet, cruising level of 20,000, and a pressurized cabin. The Company says it can carry 60 passengers across the country at less than rail rates. Two other big ships, the Martin Mars and the Douglas B-19, became obsolete during years of building. Apparently the C-69 is not, due to constant changes during the development period. But nothing is said, so far, about orders for any more. Of course the Army has taken possession of this one. The Company says that many of its characteristics are modeled after the fighter-interceptor P-38, which is making a good war record, and which is also built by Lockheed.

The British have learned their actual and potential limits on war supplies, says P. G. Johnson, Boeing president who visited England with a group of engineers. Instead of starting by specifying the number of airplanes they want to produce, they start by determining the amount of materials that can be made available. They then plan delivery of specific amounts of materials to manufacturers for a specific period, and the manufacturer must deliver the required quantities of the finished product. When the planes are finished and flying, the British are as much concerned about repairing and rebuilding them as they are about building new ones. Even though it takes as many hours as to build a new one, the material is saved. Our new Controlled Materials Plan (CMP) which goes into effect July 1, (covering steel, aluminum, copper) does roughly what the British have already done.

Standing aviation committees in House and Senate have been proposed many times. The argument is that aviation deserves permanent committees like those on Interstate Commerce, Mines and Mining, War, Navy. Rep. Jack Nichols, Congressional air fan, is promoting one for the House. Argument against standing committees is

Acme Photo

Double Spinner— Two propellers, co-axially mounted on two shafts turning in opposite directions, provide greater disc area without increased blade length and reduce torque or twist. Hamilton Standard Propeller Division of United Aircraft recently test-flew this result of long research

Joins Crocker-Wheeler

A. J. M. Baker

Gets Production Post

R. H. Depew, Jr.

President of Brill

Ronald R. Monroe

that they become strongly prejudiced in favor of their subject and promote it, sometimes regardless of the national interest.

The Aeronautical Chamber of Commerce, aircraft builders association, has taken a beating from its members. Both staff and fees are cut to one fourth what they were; the permanent president's office is abolished, and the office will be rotated among top manufacturer executives. It all happened because the Chamber ambitiously took in all sorts of borderline members: schools, parts men, etc. The two Aircraft War Production Councils, one on the West Coast and one in the East, are taking away the important functions of the Chamber, even though it has tossed out all but airframe manufacturers.

Washington Appointments

WPB, Miscellaneous:

Curtis E. Calder succeeds Ernest Kanzler as director general for operations. Mr. Kanzler has resigned because of ill health. John R. Kimberly, assistant director general for operations; William K. Frank, director of the General Industrial Equipment Div.; J. Widman Bertch, deputy director, Salvage Div.; Howard Coonley, director, new Conservation Div. consisting of the three former technical branches included in that division; Harvey A. Anderson, deputy director of this new Conservation Div.; F. Higginson Cabot, chief Commodities Bureau.

War Manpower Commission:

Lawrence A. Appley, chief, Bureau of Placement, and executive director of WMC.

Posters Promote Efforts of Wilkening Employees

PHILADELPHIA—A series of special posters featuring the use of Wilkening-produced Pedrick piston rings in naval, ordnance or aircraft units, are being used to convince that company's workers that its product is of importance to the war effort.

Between-shift meetings were held in each main building to inaugurate the display of the poster series. Each poster was explained and verbally underscored at these meetings, thereby attaining a favorable mass effect that would not have been possible by the cold, impersonal showing alone of each poster.

At the time of the poster-inauguration meetings, two goals were set up for every one to strive for: full participation in the purchase of U. S. War Bonds on a 10 percent payroll deduction basis, and winning the coveted Army-Navy "E" for excellence in war production. Production charts were set up to show the day to day accomplishments. A new poster is put on display each week. Posters are produced in red and blue on white background.

NAMES in the NEWS

A. J. M. Baker, formerly connected with the British Purchasing Commission, has been appointed general manager of Crocker-Wheeler Electrical Mfg. Co., Ampere, N. J., a division of Joshua Hendy Iron Wks. Mr. Baker served as deputy director general in charge of machine tools of the British agency.

Richard H. Depew, Jr., has been named production coordinator of Fairchild Div., Fairchild Engine & Airplane Corp., Hagerstown, Md. He has had long experience in the aviation field, and was formerly general manager and vice president of Taylorcraft Aviation Corp.

Ronald R. Monroe, who has been associated with the J. G. Brill Co. since early in 1942 as vice president, has been elected president of the company. He will make his headquarters in Philadelphia. For several years Mr. Monroe was president of the Des Moines Foundry & Machine Co., and in 1935 became director and executive vice president of the Utilities Power & Light Corp. which owned a number of manufacturing properties.

Richard E. Palmer has been appointed assistant to the vice president and assistant general manager of Bell Aircraft Corp. and has been assigned to handle problems concerning manufacturing processes. He was associated with Curtiss-Wright Corp. in the propeller department for several years prior to 1939, then became sales manager for the Aviation Mfg. Corp., remaining with that company until 1941. During the past year Mr. Palmer served in the aircraft division of the War Production Board. William B. McBride, who has been employed in various capacities by Bell Aircraft Corp. since 1940, has been named production manager, succeeding M. E. Roe. In April of last year he was placed in charge of process and facilities progress, and at the end of the year took over the duties of Mr. Roe, who took an extended leave because of illness. Mr. Roe is now devoting himself to problems in the tool engineering division.

Ralph E. Kramer has been named general manager of Suprex Gage Co., Ferndale, Mich. Mr. Kramer was formerly president of H. Channon Co. In 1928 he was appointed manager of Sullivan Machinery Co. in the Far East, and later was recalled to the plant at Claremont, N. H., where he spent two years on engineering and development research.

Arthur A. Aranson has resigned his position as assistant to the president of Crucible Steel Co. of America. Formerly he was connected with the International Harvester Co. in Chicago.

Carl G. Preis has been appointed vice president of American Can Co. in charge of engineering. He is also vice president and general manager of the Amertorp Corp., which is a subsidiary corporation making naval and aerial torpedoes.

Curtiss Ginn, Jr., has been elected first vice president and general manager of F. E. Myers & Bro. Co., Ashland, Ohio.

P. W. Foster, Jr., has been elected vice president of Foster Wheeler Corp., New York City. In 1919, Mr. Foster

joined the sales department of Power Specialty Co. and for some time was in charge of the Boston office. He moved to New York later and directed the industrial department, and more recently the steam generation division.

R. C. Wietersen has been named director of purchases for The Buda Co., Harvey, Ill., and will have charge of purchases of equipment and material for Buda gasoline and diesel engines, railroad equipment, lifting jacks, industrial shop trucks and other products of the company. For the past two years Mr. Wietersen has been director of purchases for the National Supply Co., and was previously connected with Hercules Motors and Studebaker Corp.

Fred B. Loveland has been appointed assistant general superintendent of the Youngstown district plants of Carnegie-Illinois Steel Corp., subsidiary of United States Steel Corp. Mr. Loveland has been employed by the corporation since 1906, and since 1937 has been assistant general superintendent in charge of steel works.

James S. Knowlson has resigned as vice chairman of WPB to return to his duties as president and chairman of the board of Stewart-Warner Corp. in Chicago. He entered the Office of Production Management as deputy director of priorities, and afted WPB was established he became director of Industry Operations. Last summer Mr. Knowlson was made vice chairman of WPB, and served as Mr. Nelson's deputy on the Combined Production and Resources Board.

O. W. Trumbull has become vice president and general manager of Greene, Tweed & Co., New York City. Formerly Mr. Trumbull was connected with the Asbestos Textile Co. and has had many years of experience in the packing and asbestos textile fields.

Bernard H. Sullivan has been assigned responsibility for all commercial activities involving lamps and special products for Westinghouse Lamp Div. of Westinghouse Electric & Mfg. Co., Bloomfield, N. J. Mr. Sullivan will continue in charge of the illuminating engineering and commercial engineering departments, as well as sales, advertising and division district offices. In addition he will supervise activities of the special products commercial department. Ralph C. Stuart has been appointed manager of manufacturing and engineering for the Lamp Div. and will continue to make his headquarters in Bloomfield. Both men have been affiliated with the company for many years.

Gordon F. Hess has been appointed district sales manager at Detroit for Republic Steel Corp. He has been serving in that capacity in the Houston office. Mr. Hess began his career in the steel industry in the metallurgical department of the Central Steel Co., and later became superintendent of the heat-treating and cold drawing departments. In 1922 he was transferred to the sales department and continued in general sales work at Massillon until the formation of Republic Steel Corp. in 1930 when he became assistant sales manager of the alloy steel division.

Bennett S. Chapple, Jr., formerly assistant to the vice president, operations, in charge of emergency defense coordination of Carnegie-Illinois Steel Corp., has been made assistant manager of sales of the New York district sales office. He is succeeded by Ross L. Leffler, who will coordinate emergency defense measures in the company in addition to his duties as special representative.

Robert H. Gibb, who has been assistant district manager of the Pittsburgh district sales office of Allegheny Ludlum Steel Corp., has been advanced to district manager.

C. L. Drewry has been named director general of the Toronto office of the Department of Munitions and Supply which is a new branch of the Department. Among the various divisions that are represented in this office are the Aircraft Production Branch, Ammunition and Gun Production Branch, Priorities Branch, Subcontract Div. of the Office of the Coordinator of Production, and Shipbuilding Branch.

John S. Morris has become methods engineer for By-Products Steel Corp., Coatesville, Pa., and will carry on special development work in connection with improved methods.

Curtis H. Barker, Jr., materials handling expert of General Electric Co., Bridgeport Wks., has been granted a leave of absence to join the Navy Dept. as technical consultant in its Supply Corps, where he will assist in organizing and coordinating a centralized material handling activity embracing five bureaus of the Navy.

W. A. Cleneay, who has been working with the engineering staff of Monsanto Chemical Co. at the new Texas City, Tex., plant, has been transferred to St. Louis to head coordination of the company's activities relative to camouflage, blackouts and air raids. Edwin R. Campbell, has also been transferred to St. Louis to head the salvage and surplus equipment section of the general engineering department. Milton Welhoelter, of the Nitro, W. Va., plant, has been assigned to the Texas City plant to make a special study of processing operations in the process engineering division.

Harold Niemeyer has been advanced from plant superintendent of Western Gear Works at Seattle to general superintendent of the Seattle and Lynwood plants. He will make his headquarters at Lynwood.

Keith Williams has been made president of Pratt & Letchworth Co., Inc., of Buffalo. He joined the organization in 1926 as works manager and previous to his new appointment was vice president and general manager.

Glenn W. Shetler has joined the Barium Stainless Steel Corp. of Canton, Ohio, as general manager. He was connected with Crucible Steel Co. for several years and recently organized the order and production department for the Sanderson Wks., Emerson Wks. and Halcomb Div. in Syracuse.

W. A. Phillis, formerly vice president of Beaver Pipe Tools, Inc., Warren, Ohio, has been appointed president and general manager of the organization; and W. A. Neracher, who founded the

Receive Advancements at Bell Aircraft *Joins Suprex Gage Co.*

RICHARD E. PALMER

WM. B. McBRIDE

RALPH E. KRAMER

HENRY C. PIERLE

CHARLES C. SWIFT

GEO. B. KARELITZ

company 43 years ago, has become chairman of the board. Other changes include M. W. Bechtel as executive vice president and treasurer, C. W. Shafer, vice president of manufacturing; E. R. Barkley, vice president of sales.

OBITUARIES

Henry C. Pierle, secretary and general sales manager of R. K. LeBlond Machine Tool Co., Cincinnati, died at the age of 62 following a heart attack and short illness of several weeks. Mr. Pierle received his engineering training in Cincinnati at the Technical School and University of Cincinnati. He began work as a machine shop hand, having been employed by Lodge & Shipley Machine Tool Co., Cincinnati Bickford Tool Co. and LeBlond Machine Tool Co. Since 1918 Mr. Pierle had been sales manager of the latter company, and was associated with the firm for 32 years. He had traveled widely through Europe representing his firm, and had been recognized as an expert in the manufacture of gun barrels.

Charles C. Swift, 63, president and treasurer of the Ohio Machine Tool Co., Kenton, O., died in Columbus, O. He had been associated with the company as general manager since 1911. Mr. Swift was also president of the Swift Electric Welder Co., Detroit, with a factory at Kenton, and was a director of the Cleveland Punch & Shear Works Co. of Cleveland.

George Boris Karelitz, 47, professor of mechanical engineering at Columbia University, New York City, and well known authority on lubrication, passed away after a heart attack suffered two weeks previous to his death. Professor Karelitz was chairman of the Texas Co. fellowship committee which is sponoring experiments at Columbia on thin film lubrication for machines. For the past year and a half he had been on a special assignment in the bureau of ships of the Navy Department in Washington.

John T. Fagan, 72, inventor of modern lamp machinery and connected with the lamp department of General Electric Co., Cleveland, for over 40 years, died at his home in Cleveland Heights after a lingering illness of several years. For 25 years he was manager of the lamp equipment and equipment development works of G.E. and contributed hundreds of important inventions in that industry.

Edgar Palmer, chairman of the board and former president of New Jersey Zinc Co., died at his home in Princeton, N. J., at the age of 62.

Andrew J. Hamilton, Jr., retired general sales manager of the eastern division of Hudson Motor Car Co., passed away at the age of 65. He had been connected with the company for 24 years.

William R. Thomas, 77, retired chief engineer of E. D. Jones & Sons Co., Pittsfield, Mass., passed away in that city. He had been connected with the organization for 47 years.

Harold K. Jackson, sales manager for the northern district, Mid-West Forging & Mfg. Co., died recently. He became associated with the company in 1935 and had previously been connected with Jones & Laughlin Steel Corp.

George L. Gaylord, president and treasurer of Westfield Grinding Wheel Co., Westfield, Mass., died at the age of 71 after a long illness.

Fred C. Koch, 73, president and founder of Columbia Metal Stamping Co., Cleveland, passed away in that city recently.

Harris T. Dunbar, vice president of David Bell Co., Buffalo, N. Y., died at his home recently. He was one of the founders of the Buffalo Foundry & Machine Co.

Frank C. Winters, 39, manager of the Cincinnati office of the Electric Controller & Mfg. Co., Cleveland, died recently in Cincinnati. At one time he had been associated with the Philadelphia Electric Co.

Frederick C. Blanchard, vice president and chief engineer of Rivett Lathe & Grinder, Inc., Boston, passed away. He was formerly associated with Ashcroft Mfg. Co. of Bridgeport, Conn.

BUSINESS ITEMS

Detroit Broach Co., Inc., has established a branch plant at 115 N. Robertson Blvd., Los Angeles, to manufacture and service broaching tools.

Charles F. Elmes Engineering Wks., Chicago, has become a part of American Steel Foundries. The present organization will remain intact and will operate as a separate unit.

Arnold W. Nelson succeeds the E. I. Sandberg Co. as representative of Allegheny Ludlum Steel Corp. in the Minneapolis territory. His headquarters are 3512 Glencrest Road.

Automatic Machinery Mfg. Corp., Bridgeport, Conn., has been purchased by Bolten Mfg. Co. and all operations will be carried on under the Bolton name.

American Foundry Equipment Co., Mishawaka, Ind., has announced the addition of a metal washing division for the design and manufacture of washing machines for industrial purposes.

F. F. Gilmore & Co., Boston, has moved to new factory headquarters at 285 Columbus Ave. where it occupies a modern building with greatly increased floor space.

Cochrane Corp., Philedelphia, has appointed the Energy Control Co. at 3107 N. Broad St. as flow meter representative for eastern Pennsylvania, southern New Jersey, Delaware and Maryland.

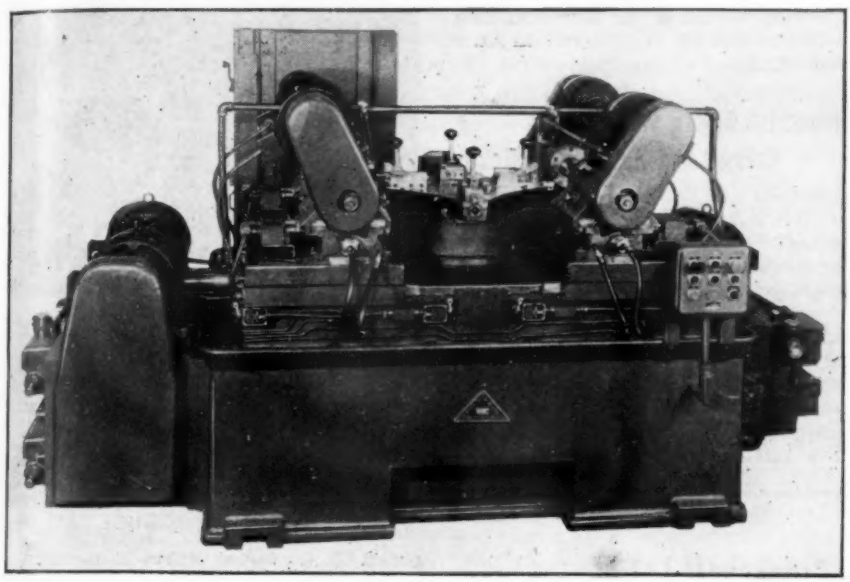
Irving Subway Grating Co. of Long Island City, N. Y., has opened a West Coast plant in Oakland, Calif., with J. C. Lynn as general manager. Establishment of this plant is intended to expedite shipment of emergency landing air field mats to the armed forces in the Pacific area.

MEETINGS

American Management Association, Annual Conference of Personnel Div., Palmer House, Chicago, Ill. Feb. 10-12.

SHOP EQUIPMENT NEWS

LeMaire Special Hollow Mill for Turbine Blades Simultaneously Machines Trunnions and Faces to Length



LeMaire Tool & Mfg. Co., Dearborn, Mich., has developed a specially designed hollow mill for machining a round trunnion on each end of a turbine blade and which faces the blade to length at the same time.

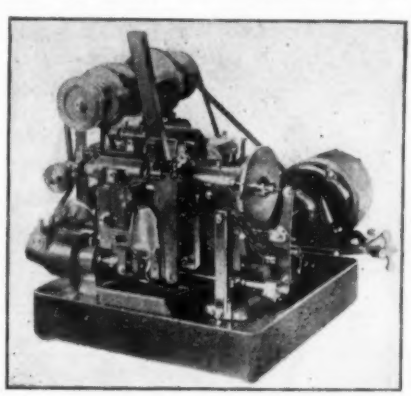
An index table carrying four special toggle clamp fixtures is mounted on the center of the machine with hollow mills on two sides operating on horizontal slides. Each slide carries two auxiliary slides on which the cutter heads are mounted. Hydraulic units mounted on each end of the machine provide power for moving the slides.

The cycle of operation is started by pushbutton control after the fixture nearest the operator has been loaded. This turns the table 90 deg. toward the left where the roughing is done. The fourth station, on the right, completes the finishing operation. As the operator loads each piece, work on the pieces already in the fixtures is proceeding. As soon as the horizontal slides are in position, the cutter heads advance toward the work and go into feed hollow milling a trunnion on each end of the solid blade stock. These heads retract on rapid return at the end of the milling cycle. When the cutters are in the back position, the horizontal slides move back to the end of the machine to complete the cycle.

Hollow milling at any angle can be performed by the pivoted auxiliary slides carrying the cutter heads. These slides are equipped with protractor and vernier scales. This feature of the machine makes it flexible enough to produce blades with trunnions straight with the axis on both ends, with one trunnion straight and the other at an angle, with a trunnion only at one end, or with both trunnions at an angle with the axis. By use of convex shaped cutters it is possible also to make the blades with a concave shape around the trunnion.

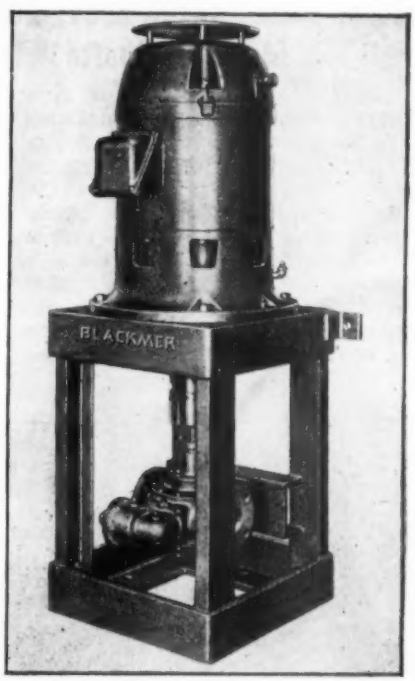
Waltham Improved Pinion Cutter Has Variable Stroke Adjustment

Improvements in the design of the pinion cutter made by Waltham Machine Works, Waltham, Mass., include the application of a motor drive unit and adjustment to give variable stroke lengths. Strokes of 3/16 to 13/16 in. can be taken.



Automatic indexes permit indexing for any number of positions and uneven spacing can easily be taken care of. The magazine can be arranged for hand feeding, or magazine feeding if the blanks are suitable for such feeding. For second or third pinion cuts two or three cutters are spaced on the arbor of the cutter spindle. The outer cutter is used for the first cut and the inner for the finish cut. After the first cutter has finished its cuts, the machine shifts the cutter slide and makes its successive cuts. Upon completion of the last cut, the machine stops with the cutter lifted and the first cutter in position for the next blank.

With small changes the machine can be used for cutting teeth on sectors, slotting ends of tap screws, milling flutes on small taps and similar tools, squaring ends of taps or rods, milling flats and other uses.



Blackmer Rotary Pumping Unit Used for Transfer of Oils

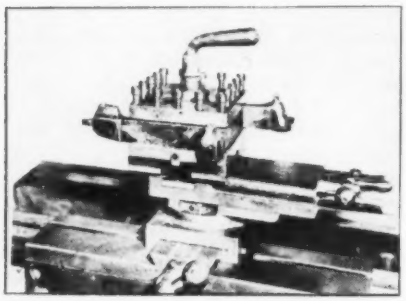
A rotary pump vertically mounted and powered by a 15 hp. gear head motor has been announced by Blackmer Pump Co., Grand Rapids, Mich. Although used for pumping diesel fuel on combat craft, this unit is adaptable for use in industrial plants requiring

the transfer of oils and other non-abrasive liquids.

The pumping unit is all bronze construction and the base is fabricated steel designed for bottom and back anchorage in mounting. Capacity of this rotary pump is 100 gal. per min. at a pressure of 100 lb. per sq.in. handling diesel fuel. The motor has a speed of 1,770 r.p.m., reducing to 440 r.p.m. on the drive shaft.

Vital Lathe Toolpost Turret Features a Double Index Lock

The Vital Machine & Tool Co., 325 16 St., Brooklyn, N. Y., has placed on the market three sizes of an improved Sure-Lock toolpost turret for engine lathes that features an automatically-operated key lock in addition to the usual pin lock for indexing. The turrets are designed with a square base in place of the usual cylindrical base, so that the square turret has a full bearing on the compound rest. The 2½×2½ in. Junior size will take ¼ to ⅜ in. high tool shanks and weighs approximately 2¾ lb. The 3½×3½ in. Standard model has capacity for ⅜ to ⅝ in. tool shanks and weighs 10½ lb. The largest turret, listed as the Master model, is 6×6 in. square and has capacity for ½ to 1 in. high shanks. It weighs 34 lb. These turrets also can be made to take standard toolbit holders as shown in the illustration.



Industrial Offers Wheatstone Bridge and Resistance Boxes

Industrial Instruments, Inc., 156 Culver Ave., Jersey City, N. J., has announced a line of Wheatstone bridge and decade resistance boxes. The Type DR direct current decade is available in standard models with resistance range of 0.9 to 999.999 ohms. All the coils are of manganin wire, except the 100,000 ohm coils of nichrome, and are bifilar wound on ceramic tubes and protective coated. The switches have self-cleaning multi-blade phosphor bronze spring wipers. The instrument is contained in a walnut case.

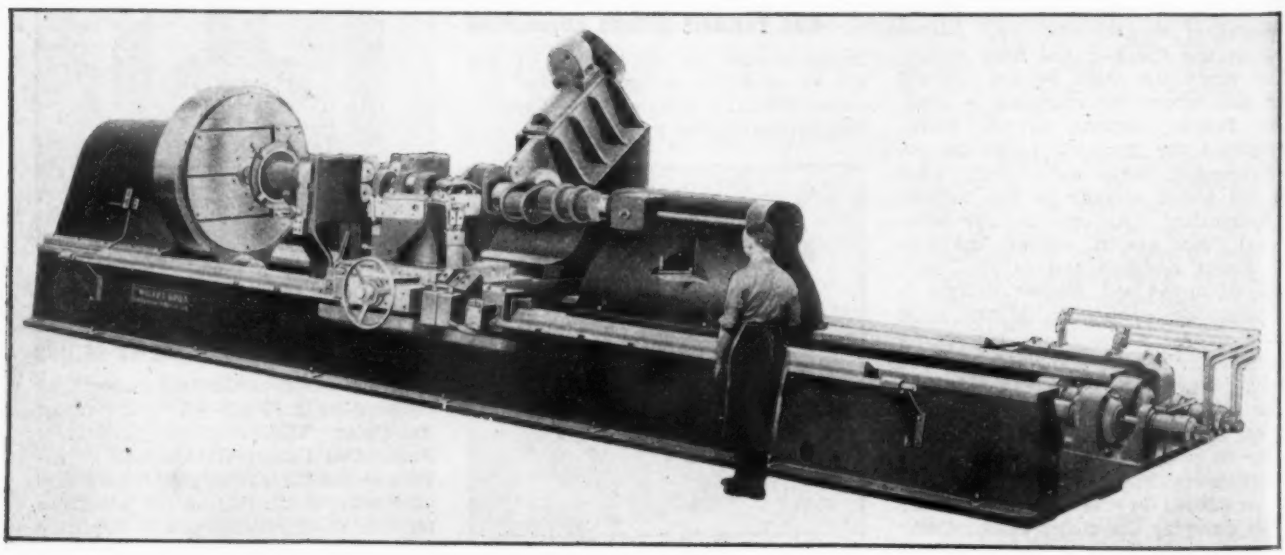
The Type RN-1 Wheatstone bridge has four resistance dials with nine positions each, covering 9X1, 9X10, 9X100 and 9X1000 ohms, with decade multiplying dials. The galvanometer is of the moving coil type with sensitivity of 1 microampere per division. Three standard flashlight cells comprise the 4½ volt battery housed in the cabinet and readily accessible without removing the panel.

Wickes Model UH-60 Heavy-Duty Crankshaft Lathe Machines Shafts With 8 or 10 In. Diameter Bearings

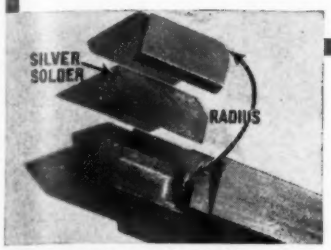
Introduction of the Model UH-60 extra heavy-duty universal type crankshaft lathe has been made by Wickes Brothers, Saginaw, Mich., for machining the intermediate main line bearings and ends of heavy-duty diesel type crankshafts having line bearings up to 8 or 10 in. diameter. This machine is a single-end drive lathe. The back roller rest is carried in a heavy back tool housing and is movable along the lathe bed to any position desired. This rest is used for supporting the bearing being machined to prevent deflection of the crankshaft during the machining operation. A heavy duty four roller steady-rest supports a main line bearing which has been previously machined.

The lathe is provided with hydraulic longitudinal feed to the carriage and with hydraulic cross-feed to the cross-slide. Hydraulic feeds provided are from 0.005 to 0.125 in. per revolution through a variable delivery hydraulic pump. A three-way turret is mounted on the cross-slide and tooling provided for the turning, cheeking and filleting operations. Electric drum switches on the apron control the main drive motor, feeds and the rapid traverses. The tailstock is movable along the bed for machining various lengths of shafts.

Swing over the bed of the lathe is 61 in. and the swing over the cross-slide is 36 in. Crankshafts up to 16 ft. in length can be handled in this lathe. The net weight of the machine with 29 ft. bed is 69,000 lb., main drive motor is 30 hp., adjustable speed, direct current.

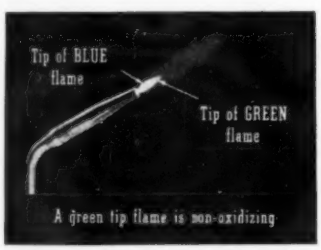


How to Torch-braze Carbide Tips to Shanks and Get Tools on the Job FAST



1 After milling and grinding shank angles, mill recess in shank to fit carbide tips. Cut silver solder sheet (.003 thick) slightly larger than recess. Clean tip, sheet and recess with carbon tetrachloride.

2 Place shank in vise as shown. Apply flux liberally to shank recess and well back of recess. Flux silver solder sheet; place in recess. Flux carbide tip; place in recess. Assembly now ready for brazing.



3 Adjust oxy-acetylene torch to 10 lbs. pressure on both gages, with a tip of green flame and blue flame as shown.

4 Apply torch along bottom. Keep moving. Then work around sides and end of shank. Avoid excessive, or spotty, heating.

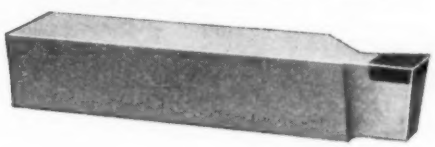
To get carbide tools on the job fast, many plants maintain an active stock of standard Carboloy Cemented Carbide tips—ready for brazing to shanks. In this way, carbide tools can be made available for most jobs within an hour after the need arises. Saves weeks—often months—of time—particularly on non-standard, made-to-order type of carbide tools. For this work you need simply an oxy-acetylene torch, and a few brazing accessories including flux, silver solder sheet or rod, etc. Procedure is simple, fast and efficient. Technique quickly acquired, even by inexperienced personnel. Carboloy Training Film available at $3.50 for fast instruction.

★ ★ ★ ★

Large Standard Tools in Stock for Heavy Work

A range of large size standard tools suitable for heavy cast iron and steel cutting work on boring mills, lathes, etc., are now in stock (1-13-43) available for immediate deliveries. In standard styles Nos. 4 and 7 (right and left hand straight turning) and Nos. 13 and 14 (15° side cutting-edge angle, left and right hand turning). Sizes 1½" square and 1½" x 2". Grade 44A for cast iron; 78B for steel.

Standard-Design Carboloy Tools for Cutting Off to Hollow Cores



Following an analysis of thousands of cut-off tools ordered in the past, standardized designs have been established for tools of this type. These cut-off tools are easy to order, speed up deliveries and eliminate special drawings. Standard-design Carboloy cut-off tools are designed for cutting off to hollow cores, such as on shell forgings, etc. Write for catalog GT-142.

CARBOLOY COMPANY, INC.

Sole makers of the Carboloy brand of cemented carbides

11149 E. 8 MILE AVE., DETROIT, MICH.

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Canadian Distributor: **Canadian General Electric Co., Ltd., Toronto, Canada**

5 When solder melts and shank and tip become dull cherry red, direct flame on the tip. Don't allow solder to become so "watery" that it all runs out from under the tip.

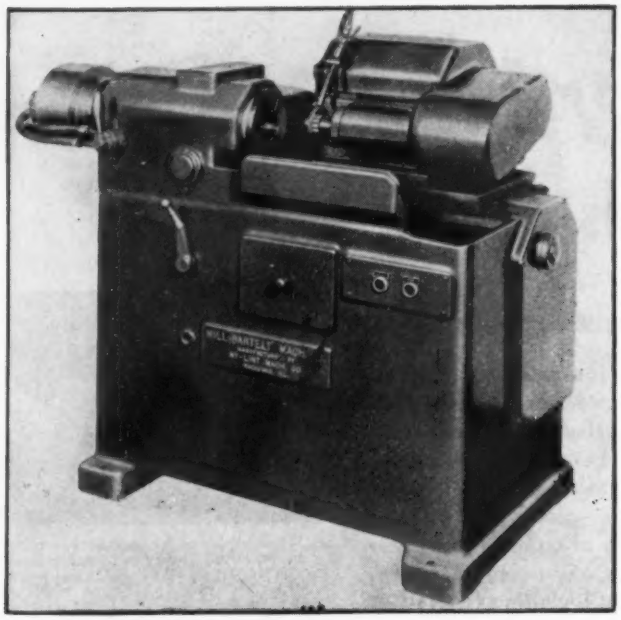
6 Then take a holding rod and move tip back and forth to wipe in joint and distribute silver solder evenly. Make certain that the solder works up around the two enclosed sides of the tip.

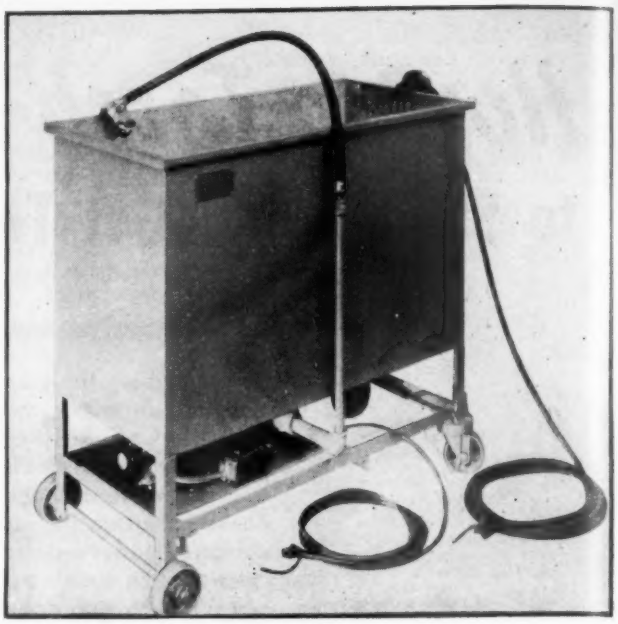
7 Now remove flame and press down squarely on tip. Heavy pressure not needed. Hold until silver solder sets.

8 Set tool aside and allow to cool naturally. *Do not quench* in liquids as tip may crack.

CARBOLOY CEMENTED CARBIDES
TRADEMARK TRADEMARK

TOOLS • DIES • DRESSERS • CORE BITS • MASONRY DRILLS • WEAR RESISTANT PARTS





Hill-Bartelt Makes Single and General Purpose Thread Millers

Hill-Bartelt Machine Co., 229 South Church St., Rockford, Ill., has announced a single purpose and a general purpose thread milling machine. The single purpose model can be used for cutting either right or left hand external or internal threads, using a multiple type thread mill. Feed is accomplished with a cam, synchronized with the work spindle which governs the complete cycle including rapid return and a dwell for reloading. The air operated collet chuck holds work up to 3 in. diameter. The controls include start and stop buttons for the motors, a feed clutch release lever and the chuck operating handle.

The general purpose model with wider range of application is equipped with cutter head that has a tilting adjustment for aligning the cutter with the helix angle of the thread. Either single or multiple type cutters may be used. Cam or leadscrew feeds are available. This machine will cut threads from 5 to 32 pitch, up to 9 in. in length with a single cutter, and up to 2 in. with a multiple cutter.

Both models are fully motorized, with all driving elements completely inclosed as well as electric controls and coolant system. The spindle is 40 in. from the floor and the machine requires 42¼ × 28 in. floor space.

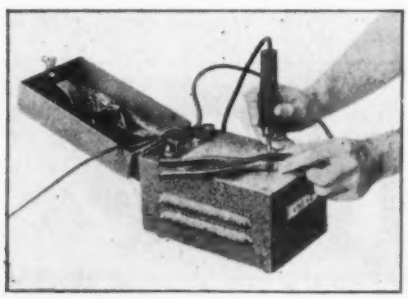
Circo Portable Cleaner Takes Any Type Metal Parts

Metal parts and assemblies of any type can be cleaned in the portable cleaner announced by Circo Products Co., 2835 Chester Ave., Cleveland, Ohio. Any cleaning solvent or compound can be used, hot or cold, and the volume of cleaning liquid is controlled at a flusher handle without stopping the motor.

The machine is equipped with a strainer for filtering metal chips and other solid foreign particles, and can be removed for cleaning without emptying the machine. A packless pump is directly connected to the electric motor of ¼ hp., 115 volts, 60 cycles, 1 phase a.c. The immersion heating unit is 1,000 watt, thermostatically controlled at 100 F. A switch is provided to operate the pump and a constant flow of the cleaning liquid flushes the work. Inside dimensions of the unit are 36 in. long by 20 in. deep, including a 2½ in. work screen height by 18 in. wide and 36 in. high. Capacity of the machine is 7 gal.

Ideal No. 13 Electric Etcher Marks Tools and Larger Parts

An all-purpose universal electric etcher, the model No. 13, which will permanently mark small tools as well as larger parts made of steel, iron or their alloys, has been brought out by Ideal Commutator Dresser Co., 1057 Park Ave., Sycamore, Ill. All parts of the unit are completely inclosed in a compact case.



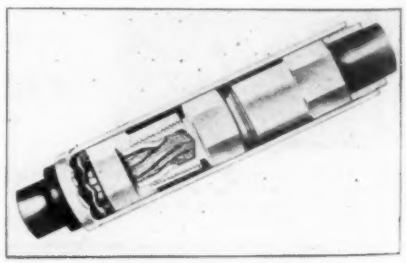
For etching small tools and parts, they are placed on the work plate and a suitable heat is selected for the job. Etching heats available in the unit are 120, 240, 420 and 700 watts. A red lamp indicates when the power is on and burns brighter as a higher heat is used.

A 4 oz. etching tool is regularly furnished with the No. 13, but for marking delicate parts a 2 oz. tool is available. The etcher is 7¼ × 5⅛ × 8½ in. and operates on 115 volts, 50-60 cycles weighs 16 lb.

National Cylinder Announces Cable-Tite Connector and Lug

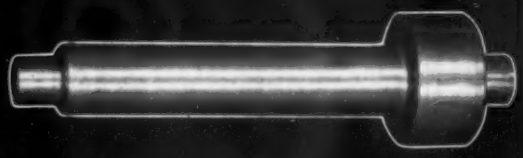
Announcement of the Cable-Tite solderless connector and lug for welding cable has been made by National Cylinder Gas Co., 207 West Wacker Drive, Chicago, Ill. The body of this connector is one-piece while the "quick" model, recommended for use where the whip end and main cables connect, has a two-piece body.

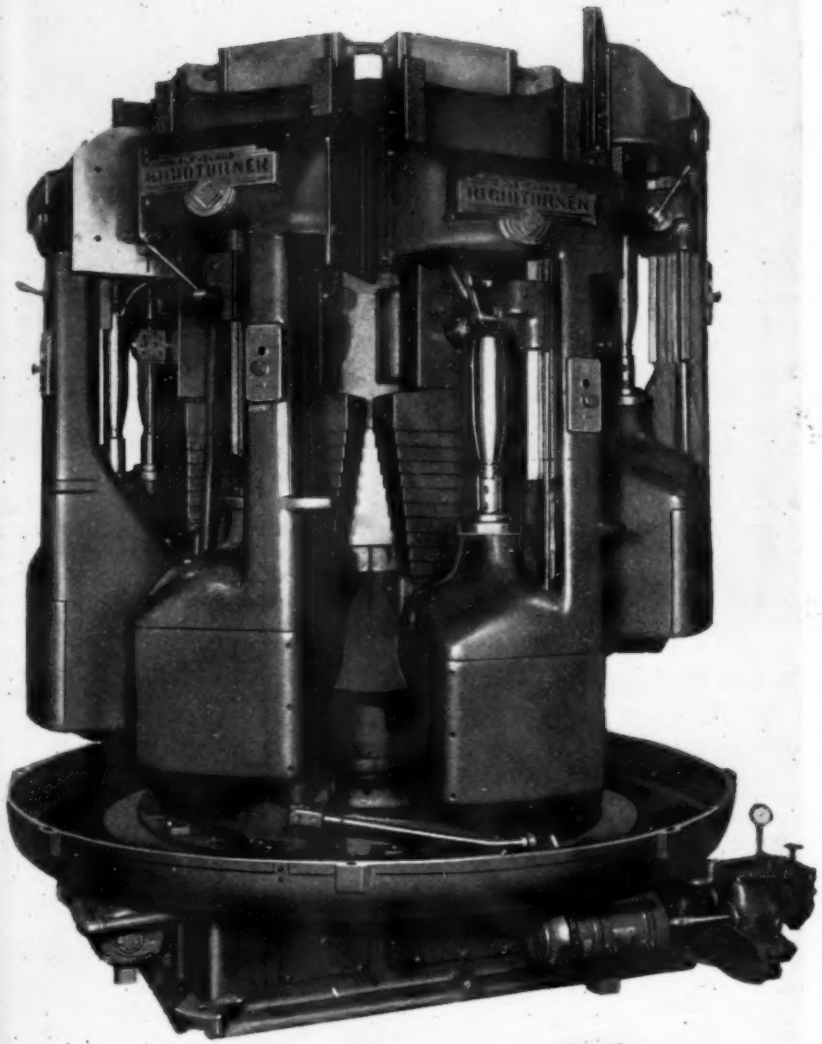
The compression collar grips the cable end and shapes it into a head



which does not work out. Because the conductivity of the fitting is greater than the cable, cool operation results. Cable lengths may be connected or disconnected by hand. The nut swivels so that the cable is not twisted. Soft rubber locks hold the insulation sleeve which is bright red in color.

For MASS PRODUCTION *of Multiple Diameters*





THE ROTARY RIGIDTURNER *Model 8618*

● Maintaining essentially the same operating functions as the single spindle Rigidturner this high production machine combines eight spindles in one unit.

This construction offers several advantages . . .

Greater production — eight pieces turned simultaneously.

Automatic operation—operator merely loads and unloads work.

Faithful duplication — each formed hob operates at the same speed and feed.

Simple to Operate — does not require specially skilled labor.

Saves Floor Space — compact design requires minimum floor space.

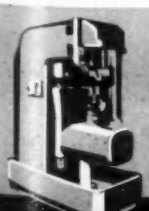
The Rigidturner

single spindle model also available for multiple diameter turnng is particularly adaptable to short runs and quick change over.

Consult CH Engineers on your duplicate turning of multiple diameter work. They will show you how the Rigidturner can increase production and cut costs.

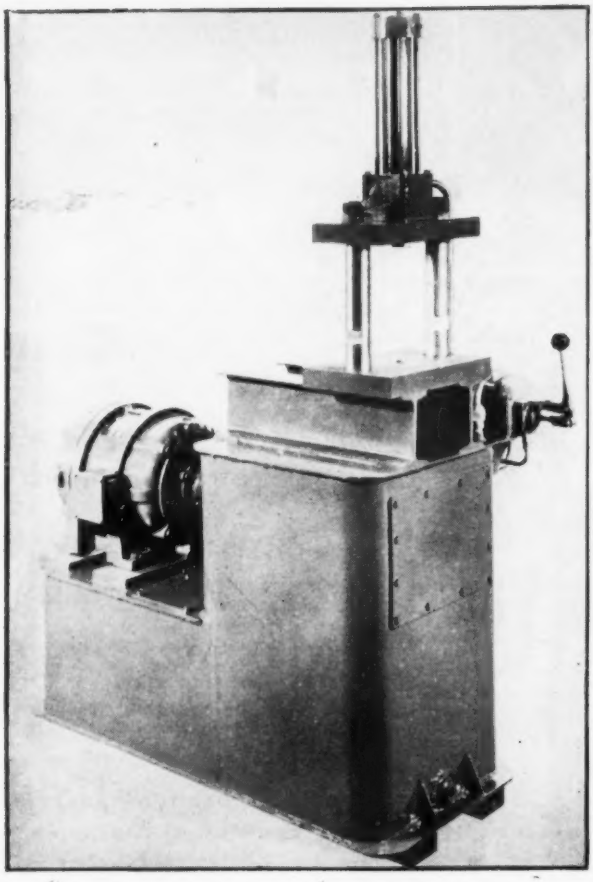
THIS BOOKLET

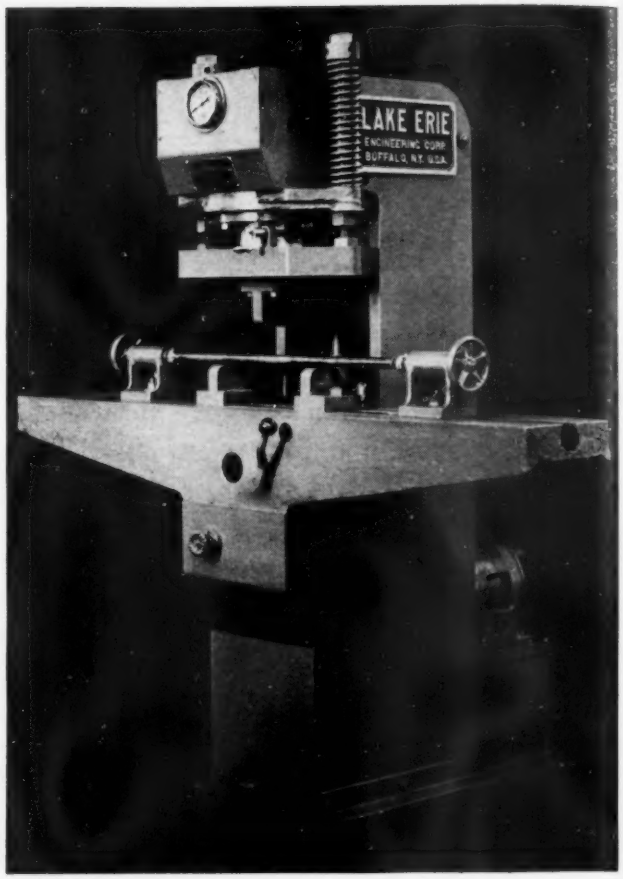
tells about Rigidturners —what they do—how they do it—and how they can save time and costs on multiple diameter turning. Write for one today.



The CLEVELAND HOBBING *Cleveland ... MACHINE Company ... Ohio*

BUILDERS OF RIGIDHOBBERS AND RIGIDTURNERS





Hydraulic Six-Ton Arbor Press Has 8-In. Maximum Stroke

A six-ton hydraulic arbor press has been brought out by Hydraulic Machinery Inc., 10421 Grand River, Detroit, Mich., with an 8 in. maximum stroke, 20 in. of daylight and an opening of 20 in. from left to right. The power unit and press are built into a single unit. It is equipped with a manually operated four-way valve which is self-centering. The motor is directly connected and rates 5 hp. on 3-phase 60 cycle alternating current and operates at 1,200 r.p.m. Control centers at a lever-operated valve which determines the direction and speed of the movement. The press occupies a floor space of 27 x 42 in. and over-all height of 75 in.

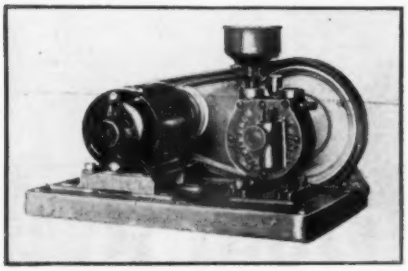
Lake Erie Straightening Press Has Hand and Foot Control

A sensitive quick-acting shaft straightening press has been announced by Lake Erie Engineering Corp., Buffalo, N. Y. It is complete with anvils and centers for testing. The pumping unit is self-contained in the base of the press and provides 20 ton capacity. The ram operates at high speed and is arranged with quick return springs. The maximum down stroke of the ram is adjusted by the control located on the yoke.

A combination hand lever and foot pedal control are so arranged that either may be used independently. Pressure control handwheel is conveniently mounted on the front of the main pedestal. The main frame is built up of rolled steel side plates electrically welded from a solid rigid unit.

Leiman Develops Vacuum Outfit For Improved Steam Heating

Leiman Bros., Inc., GB-136 Christie St., Newark, N. J., has brought out an automatic vacuum outfit for steam heating systems. It is made in a number of sizes for different sizes of heating systems, the smallest being suitable for approximately 4,500 sq.ft. of radiation.

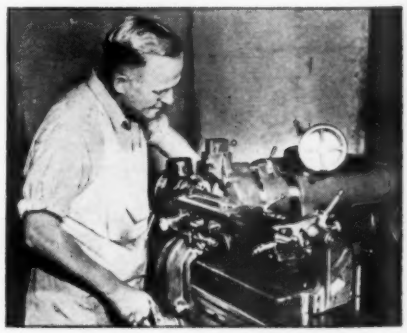


The unit consists of a motor-driven vacuum pump automatically controlled with a relief valve, air gage and automatic lubricator.

Barber-Coleman Reamer Sharpener Fixture Provides Faster Method

Application of a special fixture to the standard combination sharpening machine made by Barber-Colman Co., Rockford, Ill., produces a faster method for sharpening bore reamers or reamers with connecting tapers. This method provides complete mechanical control and insures positive duplication of original sharpening factors, eliminating the operation of hand stoning after the cylindrical grinding formerly necessary.

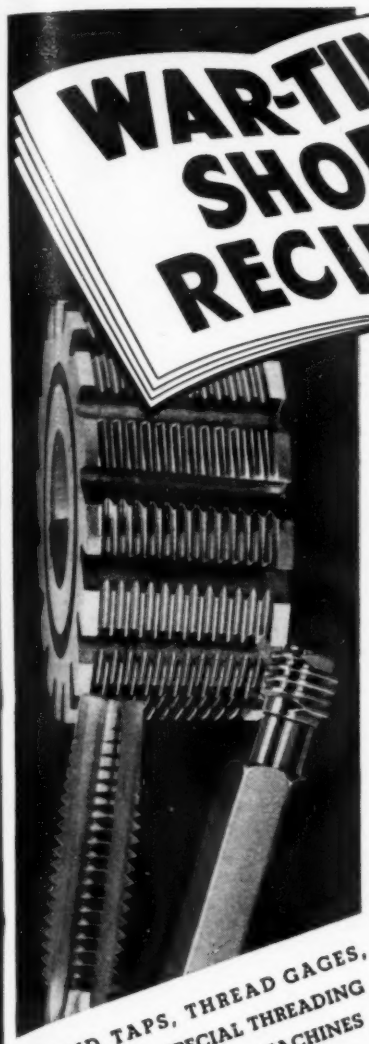
This fixture is adapted to sharpening chambering reamers for 20 mm. and



0.30 and 0.50 caliber guns. Suitable cams to apply correct form to the various tapers on the reamers have been incorporated in the fixture. These cams automatically control the correct taper during the sharpening operation. The fixture is also adjustable for face sharpening.

WAR-TIME SHOP RECIPES

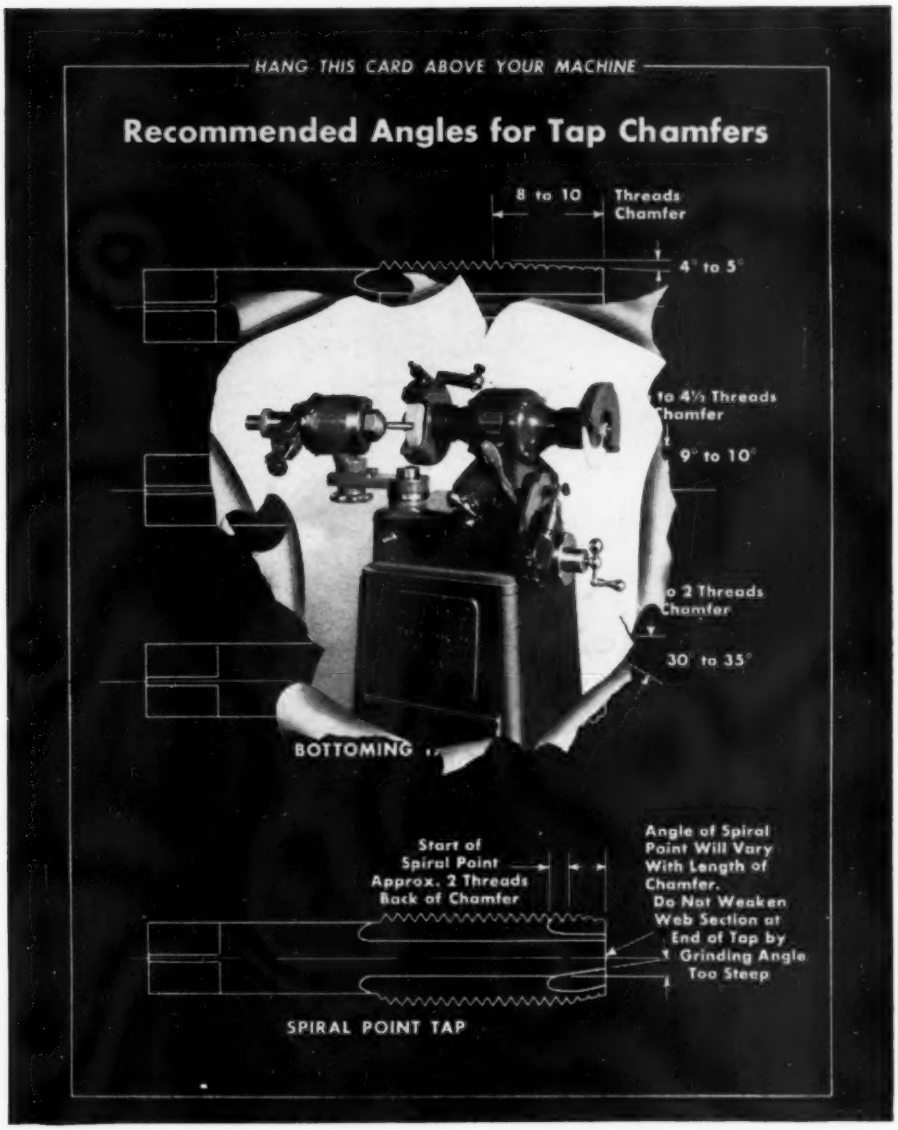
#2 for thread production



GROUND TAPS, THREAD GAGES, THREAD HOBS & SPECIAL THREADING TOOLS. SPECIAL TAPPING MACHINES

HANG THIS CARD ABOVE YOUR MACHINE

Recommended Angles for Tap Chamfers


8 to 10 Threads Chamfer
4° to 5°
to 4½ Threads Chamfer
9° to 10°
o 2 Threads Chamfer
30° to 35°
BOTTOMING
Start of Spiral Point Approx. 2 Threads Back of Chamfer
Angle of Spiral Point Will Vary With Length of Chamfer. Do Not Weaken Web Section at End of Tap by Grinding Angle Too Steep
SPIRAL POINT TAP

TAKE (1) All your dull or worn taps
(2) "Detroit" Tap reconditioning wall chart, as illustrated
(3) "Detroit" Tap Reconditioner

Then grind taps on the Reconditioner according to instructions on the wall chart and put them back to work — as good as new.

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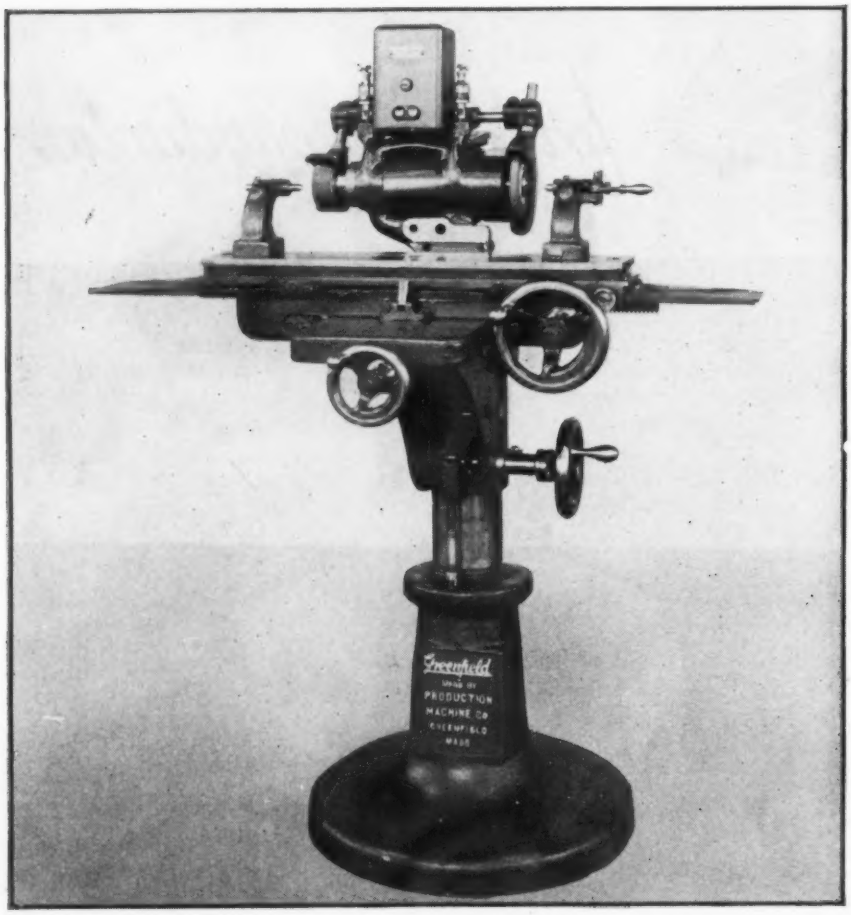
8432 BUTLER STREET, DETROIT, MICHIGAN, U.S.A.

Production Machine No. 4 Tool and Cutter Grinder Available With Cylindrical and Internal Attachments



The No. 4 plain tool and cutter grinder has been announced by Production Machine Co., Greenfield, Mass. As a No. 4U universal type it is supplied with cylindrical and internal grinding attachments as well as a 4 in. scroll chuck. The broad knee is splined to the standard, which is integral with the base. For convenience of the operator, the sleeve of the elevating handwheel is provided with graduations reading in thousandths of an inch. The swiveling wheelhead is heavy and the rigidity of the wheel is increased by the tie bar. The bronze boxes are tapered and are adjustable by means of two collars. Adjustment for end play is provided for by an additional split collar on the spindle.

The table, which rests full length upon the longitudinal slide on which it swivels, is provided with screw adjustment for accurately aligning the centers for straight or taper grinding and is graduated at both ends. One graduation represents a taper ⅛ in. to 1 ft. The other end is graduated in degrees. The longitudinal motion is operated by rack and pinion and the cross movement by a feed screw with dial graduated in thousandths of an inch.

On the universal grinder the cylindrical grinding attachment has a 1/20 hp. motor connected by V-belt to the spindle. For correct alignment a dead center is provided for supporting the work at this end. Capacity of this attachment is 3 in. diameter by 12 in. long.

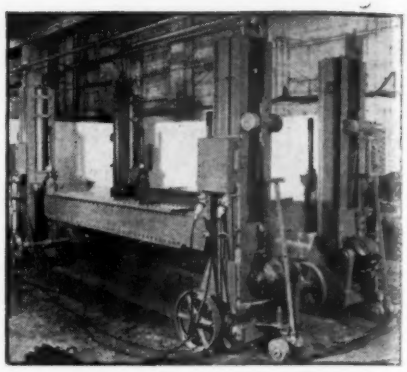
For internal grinding a 4 in. universal chuck is used in place of the driver and centers. The internal grinding wheel is mounted on a quill extending 5 in. beyond the head. Drive is through a flat flexible belt direct to the main driving motor of ½ hp. Capacity of the internal grinding attachment is up to 4 in. diameter minus the thickness of the wall of the piece with a depth limit of 5 in.

The swing over the table of the No. 4 grinder is 6¼ in. and distance between centers is 21 in. On the No. 4U the swing is 9 in. The length of table travel is 15 in. and the machine has cross feed of 6 in. and vertical feed of 7 in. Net weight of the grinder is 794 lb.

Whiting Makes High Lift Jack To Raise or Lower Locomotives

A portable high-lift, electric jack has been announced by Whiting Corp., Harvey, Ill., suitable for raising or lowering narrow or standard gage locomotives and passenger cars to facilitate many different operations.

The jack has slotted feet which permit the beams to be lowered below track level. These beams are removable so that diesel locomotives may be raised by the jack palms. The equipment is built for indoor or outdoor use and is equipped with limit switches and other safety devices. It is capable of lifting 140 tons.



Ivel Announces Lockers and Shelving Produced of Wood

Plywood and pressed wood clothes lockers and shelving have been announced by Ivel Corp., 211 West 61 St., N. Y. The lockers are light weight and finished in olive green enamel. Various sizes are available.

For assembling the shelving no hardware or attachments are required. The shelves are instantly adjustable within a wide range of spacing for shelf levels and dividing partitions and will support considerably heavy loads. The unit is furnished in solid oak, poplar or clear pine. The shelves and finishing sides are ¾ in. thick, divider sides are 1⅛ in. thick and back is of ¼ in. gum plywood. All surfaces are treated with dark green sealer stain. The splines are solid oak or birch.

CUT MACHINING TIME SET UP TIME

No. 3A DUOMATIC Performance Features

Fully automatic in operation—especially trained operator unnecessary.

Any combination of straight turning or angular "in" or "out" facing cycles, obtainable front or rear, simultaneously or independently.

Graduated tool slides can be swiveled to any angle, front or rear.

Independent mechanical feed and traverse mechanism—front or rear.

Front and rear cycles quickly changed over to suit the jobs—only simple mechanical adjustments required.

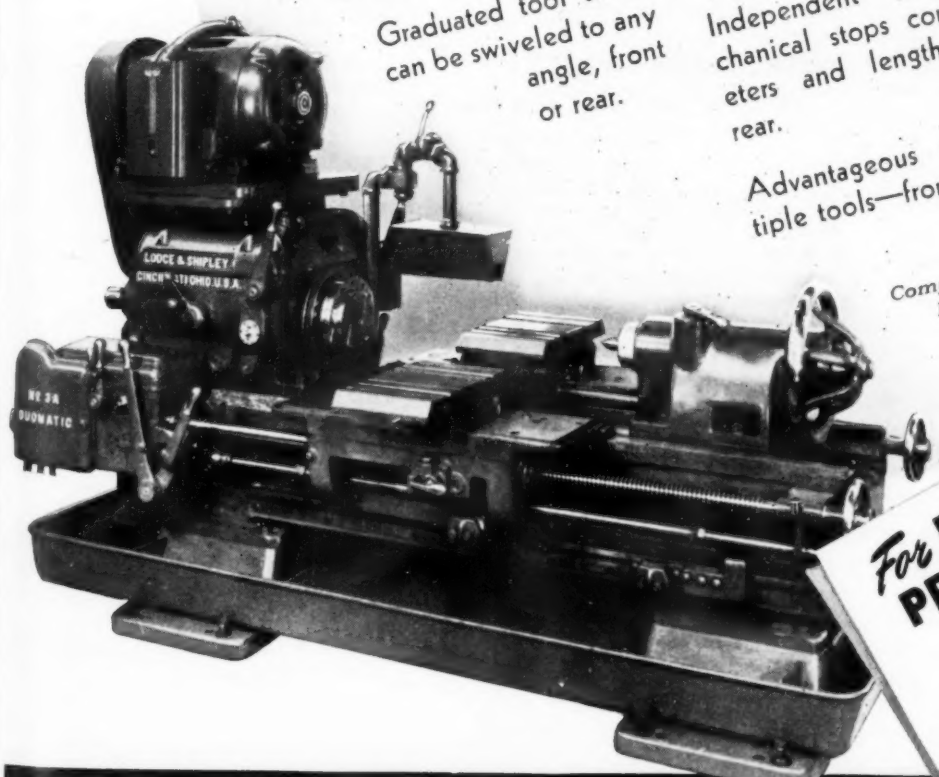
Controls duplicated front and rear.

Independent positive mechanical stops control diameters and lengths, front or rear.

Advantageous use of multiple tools—front and rear.

Write for Comprehensive Booklet No. 601-FL-742

Proudly worn since March 6, 1942

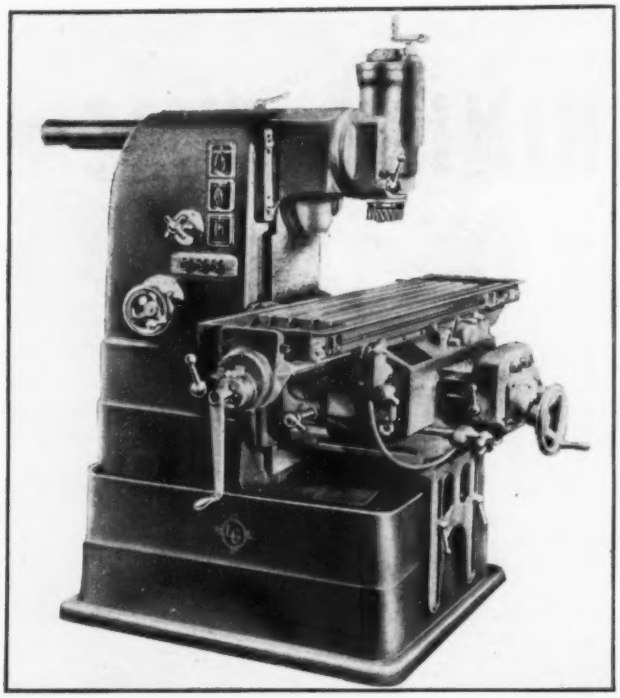


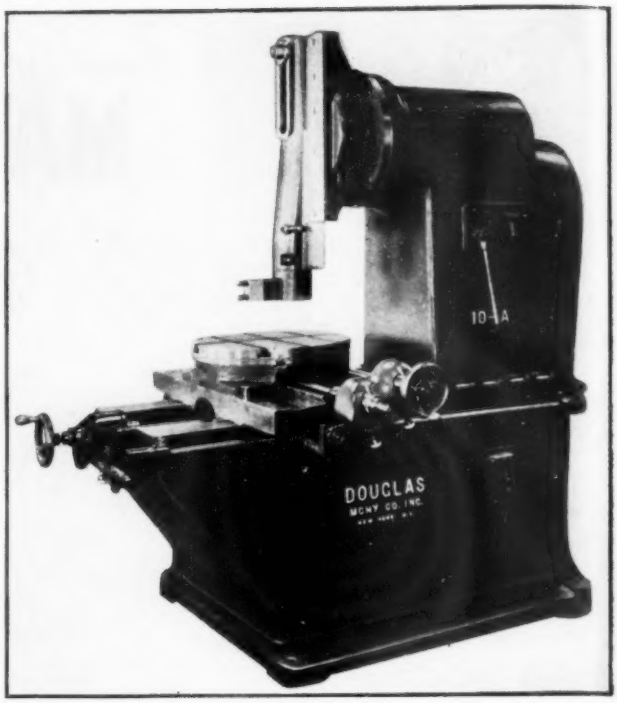
For **EFFICIENT PRODUCTION** *—in large or small lots!*

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI, OHIO, U.S.A

ENGINE TOOL ROOM AUTOMATIC LATHES





Lombard 30HV Milling Machine Handles Work in Two Positions

The Lombard 30HV universal type milling machine, which handles either horizontal or vertical work, has been announced by Lombard Governor Co., Ashland, Mass. The table is equipped with six direction power rapid traverse with 100 in. per min. in both longitudinal directions, 50 in. per min. on cross travel and 25 in. per min. elevating travel. Three bolt slots and deep coolant return wells are provided. A skip stop operation is provided for the automatic table cycle as well as automatic spindle and coolant starting and stopping. Dial equipped controls regulate the speed which ranges from 30 to 1,900 r.p.m. or 45 to 2,850 r.p.m. The machine has 18 quick change fields supplied in geometric progression, and can be conveniently changed from ⅜ to 15 in., ½ to 20 in., ¾ to 30 in. or 1 to 40 in. per min.

The vertical head gives considerable flexibility of operation. The vertical quill is hardened and fitted in a ground bore with pick-up screw and clamp. It is 4½ in. in diameter, 14 in. long and has 4 in. of power or hand feed as well as 360 deg. angular adjustment.

The work holding surface of the machines is 12×53 in. Its horizontal feed is 28 in., cross feed is 10 in. and the vertical feed is 4 in.

Douglas Precision Slotter Features Swiveling Ram Head

A No. 10A vertical slotter adaptable to toolroom and production work, with swiveling ram head and toolholder, has been announced by Douglas Machinery Co., Inc., 150 Broadway, New York, N. Y. It is available in three sizes with strokes of 7½, 8½ and 10 in., respectively. The machine has an automatic circular table with cross and longitudinal travel of 20 in. The cross-slide is gibbed to the saddle which is locked to the base with a tapered gib and two positive locking screws. The rotary table is rigidly mounted on the cross-slide, and corner clamps lock the table in any position. On the type 10A machine the table has three slots. The rotary motion is suitable for the machining of convex, concave and irregularly shaped work without special fixtures.

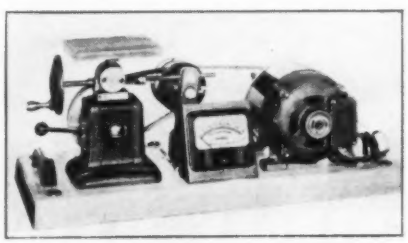
Hand or power feed is provided for all table motions. The feeds are variable and reversible and are operated through jaw clutches and ratched feed. A friction clutch protects the feed mechanism of this machine against overload. All three feed screws have quick adjusting micrometer dials.

The ram driving mechanism is of the crankpin and sliding block type. The length of stroke can be adjusted by loosening one check nut and sliding the crankpin block by turning the screw to the length of stroke desired. The ram head swivels 15 deg. either side of vertical and bolts hold the ram at the desired angle. A plunger locates the head in the vertical position.

This machine has six speeds obtained by a gear shift lever conveniently located. The No. 10A machine occupies a floor space approximately 48×76 in. and weighs about 3,600 lb. net.

All-American Vibratron Unit Does Vibration Fatigue Testing

The Vibratron, a vibration fatigue testing machine, has been announced by All American Tool & Machine Co., 1014 Fullerton Ave., Chicago, Ill. It is a portable unit mounted on a hardwood base. The table movement is vertical, but with the addition of light angle plates attached to the table horizontal or angular testing can be done. Articles up to 10 lb. may be tested with this equipment. The machine is driven by a ½ hp. 60 cycle split phase motor.



Frequency is adjustable while the machine is in operation from 10 cycles per sec. to 60 cycles per sec., registered by an electric tachometer. The maximum testing capacity is 28 grams.

New Method Steel Type Holder Made for Mounting in Presses

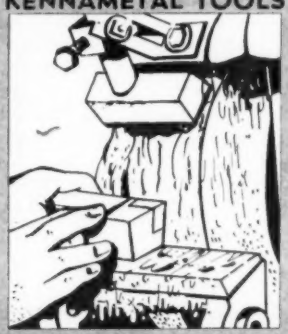
An interchangeable type holder suitable for mounting in mechanical or hydraulic presses has been announced by New Method Steel Stamps, Inc., 145 Jos. Campau, Detroit, Mich. A wide variety of figures, characters and logotypes can be used for marking parts with dates, drawing or serial numbers and code symbols. The wedge lock method of retaining the characters in the holder makes it possible for all characters to be held rigidly sidewise

CORRECT TOOL HANDLING *Increases Production*

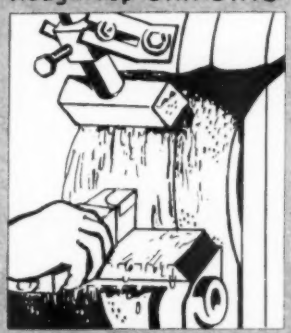
RULE 2

USE CARE IN ROUGH GRINDING KENNAMETAL* TOOLS

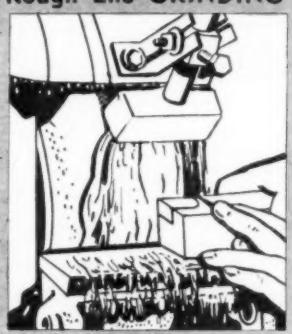
ROUGH GRINDING
KENNAMETAL TOOLS



Rough Top GRINDING



Rough End GRINDING



Rough Side GRINDING

ROUGH GRINDING

Rapid grinding is possible on large green or grey grit special loose bond silicon carbide wheels, using a water coolant with enough sal soda to make an alkaline solution and prevent rusting of the machine. A 60-grit soft bond wheel of as large a diameter as possible should be used. A 20-inch diameter wheel is preferred for the usual run of large tools such as are used in machining shells and other armament.

The coolant should cover the entire working face of the wheel and make contact with the wheel just above the tool. A spur wheel dresser should be used frequently to keep the new silicon carbide crystals exposed. An experienced operator can keep the wheel dressed, with the tool being ground, by maintaining a constant movement of the tool back and forth across the wheel as well as rocking the tool in both directions. A fairly heavy pressure should be used in order to break the silicon carbide crystals and thus maintain a free cutting wheel.

Light pressure merely dulls the wheel and causes a sudden local generation of heat in the tip or steel shank. The flow of water, hardness of the wheel bond, and other grinding conditions should be such that the tool, pulled rapidly away from the wheel while grinding, should not feel warm when touched with the finger.

To permit rocking the tool in all directions during the roughing operation, a narrow tool rest (approximately 1½ inches) should be used. This rest may be set at an angle about 2° to 3° more than the clearance angle required, thus permitting a final pass over the wheel with the tool held on the rest, to true up the angles for finished grinding.

*INVENTED AND MANUFACTURED IN U. S. A.

KENNAMETAL
THE All American CARBIDE

McKENNA METALS Co.

103 Lloyd Ave., Latrobe, Pa.

Trade Mark Reg. U. S. Pat. Off.

Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York
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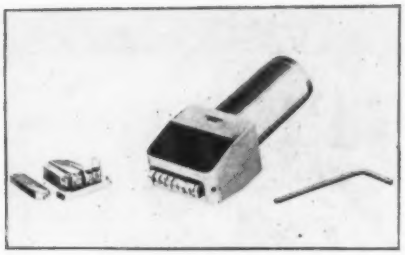


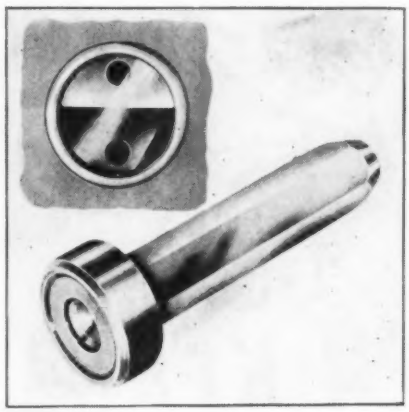
and endwise by a single socket type setscrew.

The body of the holder is machined from a solid block of steed with a separate hardened and ground anvil inserted in the bottom of the letter mortise to prevent sinking of the characters. This type holder is available for type sizes ranging from 1/32 up to ¼ in. in various type faces. All the characters are hardened and are beveled to reduce wear and to prevent chipping of the letter faces.

Bijur Plastic Oil Window Unit Gives Clear Oil Level Reading

For conveniently indicating oil level Bijur Lubricating Corp., 22-08 Forty-Third Ave., Long Island City, N. Y., has introduced an oil window unit. It consists of a window of clear plastic assembled in a polished metal housing. An oilproof synthetic gasket insures oil-tightness between window and frame. Two holes in the metallic background give easy passage to the oil.

By use of the assembly tool shown the oil window unit may be pressed into a reamed hole in the machine

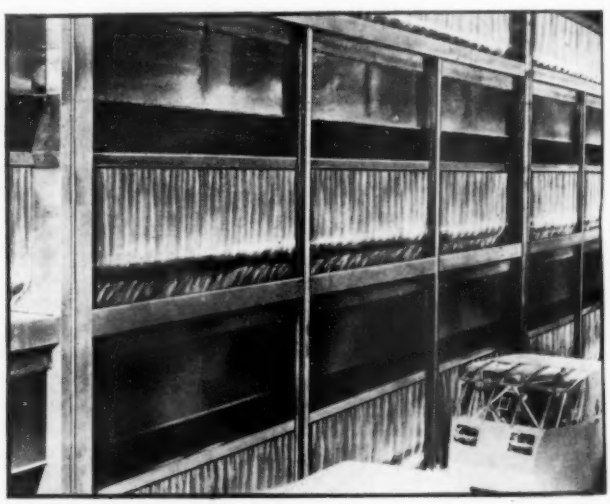


casting where the casting wall thickness is ¼ in. or more. This tool gives correct alignment of the unit with the machine face and prevents scratching of the window unit. Oil window units are furnished in ⅝, 1 and 1¼ in. diameter sizes.

Duro 6-In. Rotary Table Fits Inaccessible Places

A 6-in. rotary table has been introduced by Duro Manufacturing Co., 800 East 61 St., Los Angeles, Calif., which is small enough to get into unusually inaccessible places. The table has a worm gear ratio of 60 to 1. Backlash has been eliminated by an eccentric adjustment between the worm and gear.

The unit has a beveled dial graduated to tenths of a degree. Two T-slots cross at 90 deg., forming four quadrants. For fixing the position of the table a T-lock screw is provided. Construction of the Duro table is semi-steel. The height is 2⅛ in. and net weight is 14½ lb.



Lyon Makes Welding Positioner With Hydraulic Elevating Table

Announcement of an hydraulic elevating welding positioner has been made by Lyon-Raymond Corp., 1092 Madison St., Greene, N. Y., with a hydraulic tilting and elevating table having a ½-hp. motor-driven pump. The table revolves in any position by a worm gear arrangement and is self-locking at any point within its revolution. It will tilt 90 deg. from horizontal to vertical. The diameter of the table is 30 in. with T-slots for ⅝-in. bolts. The lowered height to the top of the table in horizontal position is 28 in. and elevated height is 40 in., elevation with table in any position being 12 in. This table can be removed by taking out four cap screws so that welding fixtures can be attached to the same top plate. Capacity of the positioner is 2,000 lb.

Binks Three-Deck Spray Booth Made With Nine Units to a Row

A large size three-deck spray booth has been announced by Binks Manufacturing Co., 3114-40 Carroll Ave., Chicago, Ill., each row containing nine units. The tier arrangement provides three exhaust points, the lowest being at floor level, the second 14 ft. above floor level, and the highest 28 ft. above floor level. Each dynaprecipitor unit measures 16 ft. wide and 11 ft. 8 in. high and is constructed of steel, each panel being formed with companion flanges punched on 5 in. centers for bolted assembly. All the units have a set of eliminators arranged in staggered angular positions and access is provided through a removable panel at the back.

Each tier of units is equipped with a recirculating pump. The water is pumped from the collecting pit through the main and water curtain manifolds that have orifices for releasing water for washing operations. Excess water passes through a return pipe to the collecting pit, thus providing for continuous circulation and eliminating the

AFTER CUTTING OILS—WHAT?

A statement of tremendous interest to everyone engaged in metal working

SINCE OIL first replaced water as a tool coolant many years ago, the development of various compounded oils and water emulsions has helped make possible present day mass production. However, we at Quaker Chemical Products Corporation were convinced that the cutting fluids now in general use represent only one step — a comparatively early step — in the continuing evolution of tool coolants. We, therefore, determined long ago to anticipate the *next* step.

In our superbly equipped research laboratories a picked staff of chemical engineers went to work to find out just how and why a cutting fluid works.

Lubricity—What Is It?

Every liquid, of course, possesses some degree of "lubricity" — the ability to form a protective film against friction — but we wanted to learn much *more* than this fixed definition. Once we learned the "how" and the "why," we would know the fundamental *causes* of known results. This, we felt, would give us the basis for developing something startlingly new.

Now, as our research advances, we realize more than ever how much there is yet to be added to the total knowledge of the subject. But our men have already uncovered many facts which have enabled us to develop *new types* of chemical fluids for use in metal machining.

Some of these new type products are now producing sensational results in actual large scale production . . . helping to turn out more and finer finished parts for the tanks, planes and guns needed by our armed forces.

Can Straight Cutting Oils Be Replaced?

These new materials are synthetic, organic compounds that form permanent emulsoid solutions. They act as *polar* emulsions and actually plate-out on the metal a lubricating film that is far more tenacious than oil. *These solutions can be used wherever straight cutting oils are used,* except in cases where water might affect bearings of certain machines. This is, of course, only a mechanical limitation.

Think of a mixture of chemicals and water producing better — yes, *better* — results than sulphur fatty oils on difficult machining jobs such as broaching, deep drilling, milling and similar jobs! Seems almost incredible, doesn't it? Yet, when you consider that the lubricating film is more adhesive than oil and that the superior refrigerating qualities of water are utilized, it is easier to understand how these new type products not only can replace straight cutting oils, but can actually permit tools to run for longer periods between grinds. Being water solutions, they are also a great deal more pleasant to work with than are oils.

Production Data Now Available

For the benefit of production men who are interested in keeping abreast of developments resulting from Quaker's research, we have prepared authentic technical data sheets. Some contain facts on the appearance, characteristics, use and application of new products. Others give specific data on various machining jobs — actual plant production reports by Quaker Process Engineers. All are yours for the asking.

Quaker Process Engineers are located in leading industrial centers. They are trained technical men who have had years of experience in metal processing plants. Before they came with us they "cut their eye teeth" as chemists, metallurgists, methods engineers or superintendents of industries such as yours. They talk your language and know how to translate our new developments into increased production.

Should you be interested in knowing just what our new type coolants can do to help you handle a difficult metal cutting problem — or possibly to increase machine production throughout your plant — drop us a line. A Quaker Process Engineer will be glad to sit down and talk shop with you.

QUAKER CHEMICAL PRODUCTS CORP.

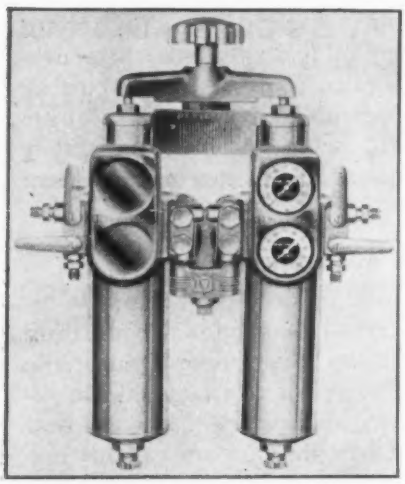
CONSHOHOCKEN, PA.

clogging of manifolds. Both the supply and return pipe lines of the water curtain manifold are equipped with valves which give complete control of the flow of water, ranging from 1 to 6 gal. per lineal ft. across the entire face of the water curtain.

Exhaust units having capacity of 70,000 cu.ft. per min., equipped with blowers driven by a 30 hp., 440 volt, 60 cycle, 3 phase motor, are provided with each tier of dynaprecipitor units.

DeVilbiss Air Transformers Is Double Barreled Type

A double barreled Type HLC heavy-duty air transformer, having capacity in excess of 100 cu. ft. per min., has been introduced by DeVilbiss Co., Toledo, Ohio, for use on automatic spray painting installations and other operations where a large amount of



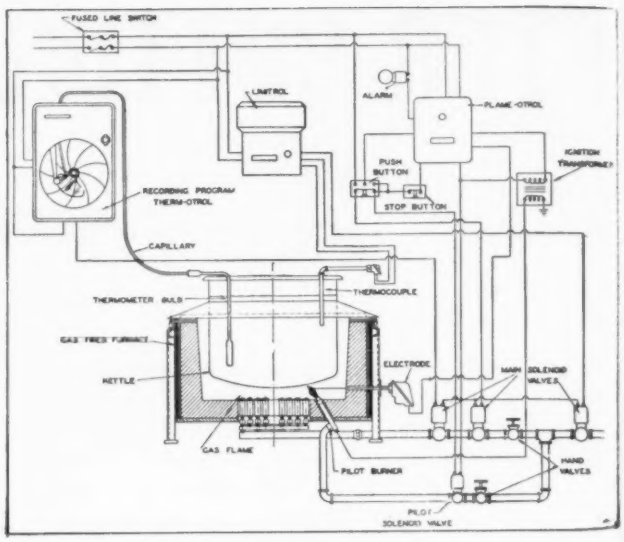
regulated air is needed. The two pressure regulators in the transformer are simultaneously controlled by a single knob. The filtering and condensing mechanisms are the permanent, all-metal type requiring no replacement of parts.

The fast-acting regulator diaphragms are made of reinforced, oilproof synthetic rubber and are chatterproof. Each of the twin cylinders may be equipped with water drains.

Wheelco Temperature Control Used for Furnace or Salt Bath

Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill., has announced an automatic temperature, cycle or program control for pot type furnaces, processing kettles or salt bath heat-treatment applications. Features of the installation, designed to control fuel, are to automatically provide the desired temperature at any period in the process regardless of the temperature variations required, to provide a record of temperatures experienced during the cycle, and to give excess temperature shut-off protection and protection against burning materials with

This unit automatically provides temperature desired at any period in the process, and excess shut-off protection, in addition eliminates combustion hazards



low flash points, also to eliminate combustion hazards. The control may be applied to gas- or oil-fired equipment.

Enforcement of any desired heating or cooling cycle over any time period is achieved by a Wheelco Thermotrol. An index arm, with a small wheel riding on the outside edge of the disk, changes the control setting to give the heating or cooling cycle called for by the rotating disk. The thermometer bulb of the Therm-otrol is suspended in the furnace or kettle. When the Therm-otrol calls for heat, a solenoid valve, shown schematically in the main fuel line ahead of the main burner, releases fuel that is ignited by a continuous pilot burner. As soon as the temperature has reached the level called for at that period in the process this unit closes the valve.

A Flame-otrol unit protects against pilot failure. An electrode is mounted so that one end is in contact with the pilot flame, and if the circuit of the flame is interrupted the Flame-otrol will close a main line solenoid valve and another in the pilot burner bypass line. An alarm bell advises the operator when fuel is shut off.

Use of a Limitrol provides protection against the possibility of valve or control instrument failure upsetting a process or treatment by overheating or heating above the flash point. This instrument is actuated through a thermocouple suspended in the furnace of kettle. If excessive temperature, at which the Limitrol is set, has been reached the fuel flow is instantly stopped to both main and pilot burners. Operation of the equipment cannot be resumed until the temperature of the material is reduced to a point below the Limitrol setting.

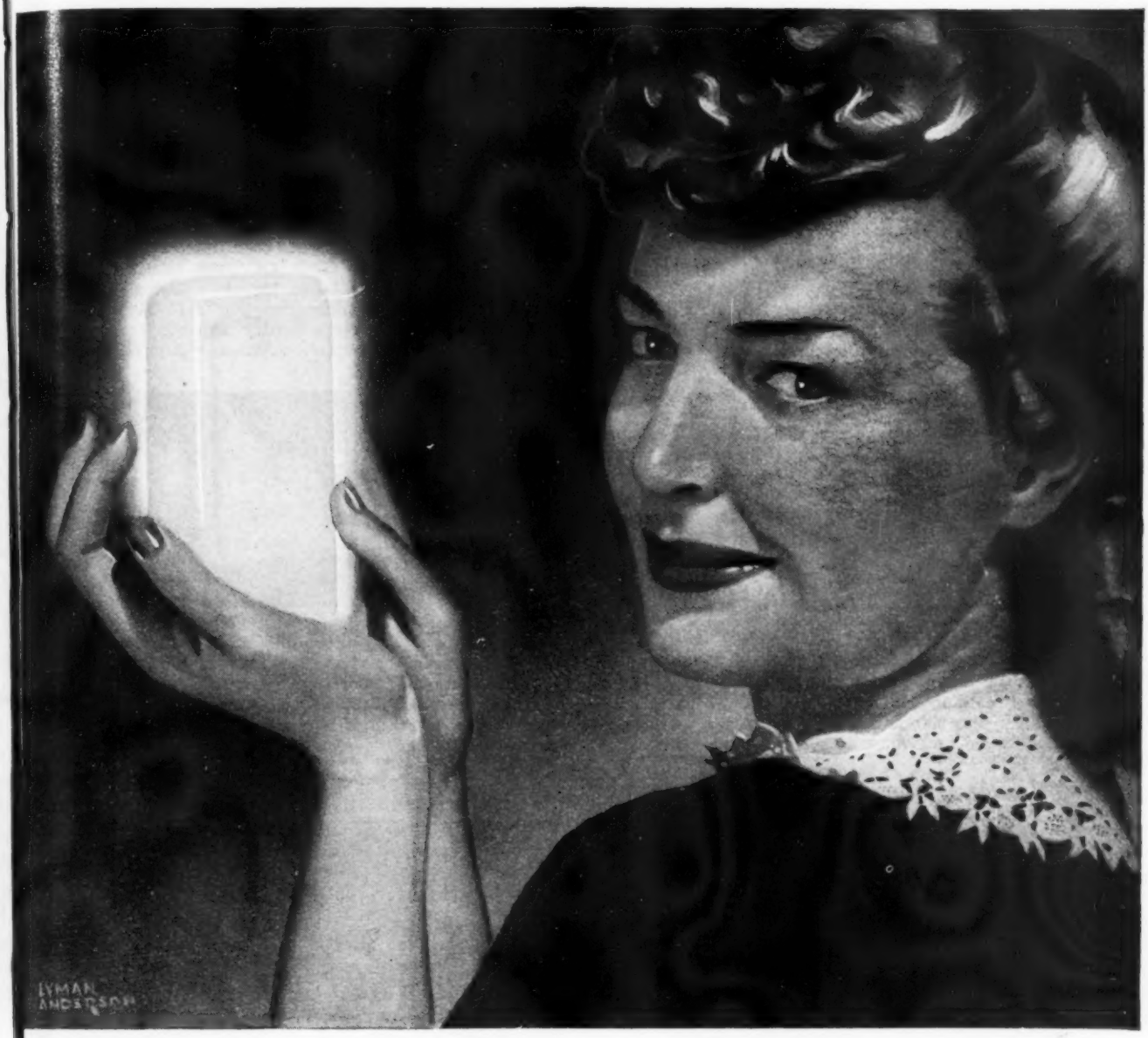
Scherr No. 1120 Tool Chest Includes a Drill Block Drawer

An addition to the line of "GS" tool chests has been announced by George Scherr Co., 128 Lafayette St., New York,

N. Y. The No. 1120 oak toolmakers' chest has eleven drawers. These include a drill drawer which may be used either to hold a drill block or handbook. All drawers are felt lined. The chest has a lacquer finish, extra heavy hardware, leather handle and two locks for added safety. Dimensions of this No. 1120 chest are 20×9¼×16¾ in.

Rubberflex Insulated Bushing Absorbs Vibration and Shock

A rubber insulated bushing, known as Rubberflex, capable of absorbing vibration and shock and of taking torsional and radial movement without lubrication has been introduced by Bushings, Inc., 3447 West Eleven Mile Ave., Berkely, Mich. A wide range of sizes is available exclusively for armed combat equipment. The bushing employs a thin layer of live rubber held between an inner and an outer cylinder of metal. The bond between the rubber and the metal is mechanical and insures a slip proof bond for high tor-



The shape of things to come is no secret

THE humming noise you hear is industry at war. When peace comes, that sound need scarcely change its pitch. For in business offices, on assembly lines, in civilian defense centers, and at home, American women are already wishing up new things for industry to make.

They want us to help them keep house, to supply new equipment for it on a scale that makes past performances seem like daily practice. Home laundries that "do" everything from tablecloths to negligees. Ranges complete with pressure cookers and unbreakable transparent ovens. Refrigerators with compartments that hold each food, from frozen meats to lettuce, at the ideal temperature and humidity.

Whatever makes housekeeping easier and more economical, women will be waiting for industry to supply. The problem is not what to make, but *how*. Which material, new or old, will contribute the most in beauty, strength, economy, to each part of the new design? How shall it be used, fabricated, finished? Where can it most effectively save weight, cost, time?

For impartial answers to questions about metals industry can turn to Revere. For just as industry in the future will not be restricted to the traditional materials, neither will Revere. In addition to broadening still further the uses for copper and its alloys since the start of the war, Revere has developed facilities for the manufacture of the light metals, and is pioneering in the production of entirely new alloys with important properties that can cut manufacturing costs for many industries.

Today the copper industry is working all-out to win the war. No copper is available for anything else. But post-war planners with specific problems in metals are referred directly to the Revere Executive Offices in New York.

REVERE

COPPER AND BRASS INCORPORATED

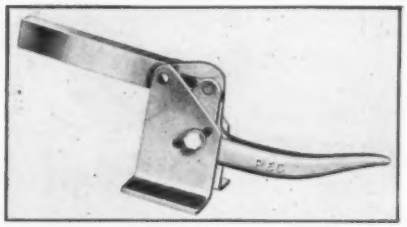
Founded by Paul Revere in 1801

Executive Offices: 230 Park Ave., New York

sional angles. The rubber bushing is of greater outside diameter than the outside cylinder and smaller than the inner cylinder. The relative resistance to slippage on either inner or outer cylinder can be increased or decreased as required.

Pec Self-Adjusting Jig Clamps Will Lock in Many Positions

A line of Pec self-adjusting jig clamps has been announced by Products Engineering Corp., 700 East Florence Ave., Los Angeles, Calif., which can be locked in many positions up to 15 deg. above



or below horizontal by means of a slotted opening that operates similar to a pair of pliers. Besides the adjusting feature the clamp has a positive lock, which is available in many types of this device. Pec clamps are of drop forge construction and quick-acting.

American Metal Makes Boxes In Sizes to Specifications

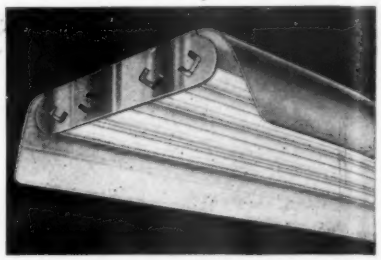
Spare parts boxes of steel have been announced by American Metal Works, Inc., 1509 Germantown Ave., Philadelphia, Pa. These boxes are made in a variety of sizes to required specifications. They are of all-welded construction with hasps, heavy hinges and drop handles at each end.

Edmont Gloves for Women Protect Hands From Acids

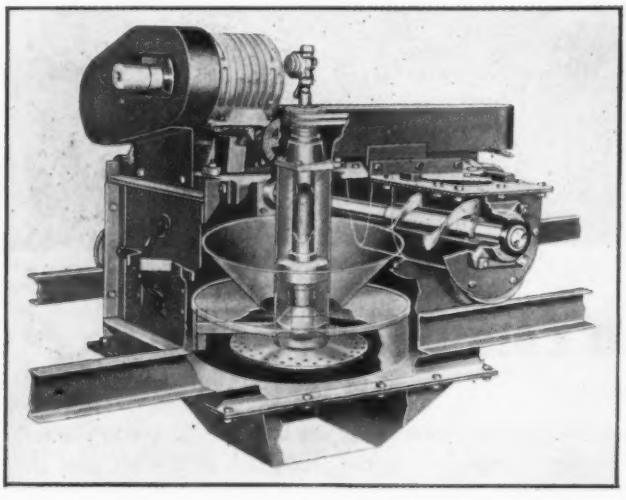
Industrial gloves for women workers are offered by Edmont Manufacturing Co., 575 Orange St., Coshocton, Ohio. They protect the hands against solvents, acids, chemicals, caustics and other corrosive materials. The gloves are reinforced with a fabric lining which protects them from snagging and tearing. Medium and large sizes are available in gauntlet type.

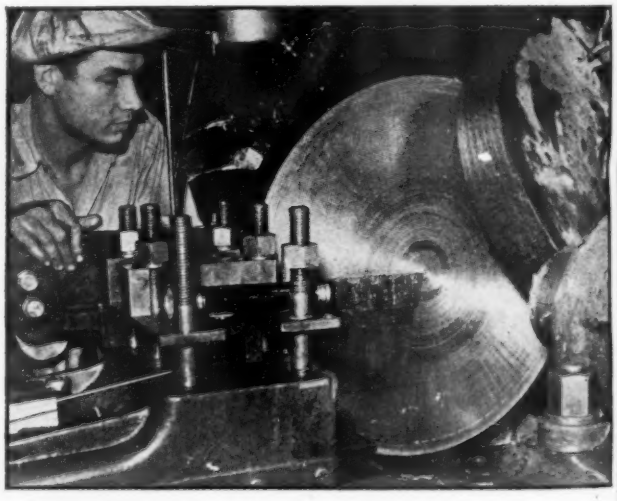
Guth Wood Reflector Fixture Equipped With Forlamp Ballast

A Super-Maze-Lite wood reflector fixture has been introduced by Edwin F. Guth Co., 2603 Washington Ave., St. Louis, Mo. It is designed to furnish illumination for high-bay areas and high-intensity lighting for industrial inspection areas. Bump-proof ends



protect the lamp holders against damage. The unit is available with the Forlamp ballast for 265 volts; for 110-125 and 220-250 volt circuits, in sizes for four 40 watt or four 100 watt fluorescent lamps.





American Screw Conveyor Feed Allows Uniform Dust Discharge

To provide a constant and uniform rate of feed of discharged dust from dry type dust collectors into sludge forming devices, American Foundry Equipment Co., 555 South Byrkit St., Mishawaka, Ind., has added a screw conveyor feed to its wet disposal unit.

The dust which falls from the collector hopper through a flexible coupling is deposited into the conveyor of the wet disposal unit. The rate of feed of the dust into the mixing chamber is controlled through gear speed reducer and variable speed pulley.

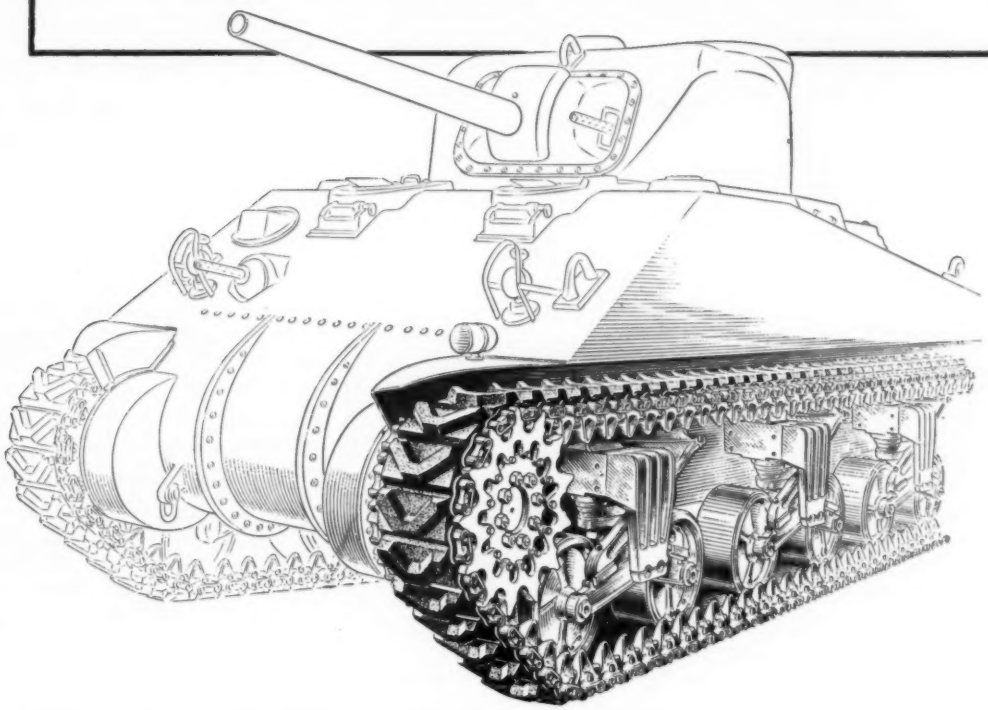
At the same time dust enters the unit, water or other liquid is discharged at the center of a high-speed mixing disk causing an instanteous mixture of them. This sludge is then discharged at the bottom of the unit. By controlling the volume of dust and water fed into the unit any desired consistency of sludge can be made.

Anthony Makes Cutting Off Tools For Engine and Turret Lathes

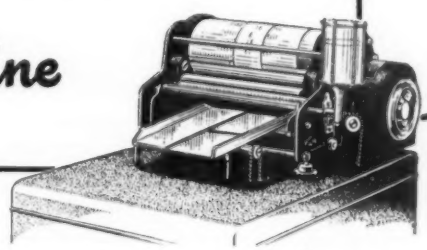
An "E" series of cutting off tools for engine lathes is included among the recent developments announced by Anthony Tool Co., 233-241 Fredericksburg Road, San Antonio, Texas. In this series, tools for making maximum diameter cuts of 2, 4, 6, 8, 10, 12, 16 and 30 in. are available. For delicate work, blades of 1/16 in. thickness are used, while for heavy work, cutting 30 in. or more, 7/16 in. blades are used. The pivoting trunnion and safety-slip on all models, and the supporting blade on all but the small models, prevent chattering in the machine, damage to equipment and breakage of blades.

For turret lathes the models are known as the "T" series and the numbers indicate the maximum diameter of cut which should be made. The 3 and 4 in. models are known as the "ST"

the Tank took a hint from



the Duplicating Machine



THERE'S NO maintenance man in most offices, making regular trips with a grease gun to see that bearings have plenty of lubrication. That's one of the reasons why builders of business machines selected the Torrington Needle Bearing to lengthen the service life of their products.

With Army tanks, of course, it's entirely different. They're regularly and thoroughly inspected by highly skilled maintenance crews. But when a tank comes back from the battlefield, and the crew starts racing against time to get it ready for another lightning dash against the enemy, there's a big advantage in having bearings that seldom need attention. So the tank designers, like the business machine builders, turned to the Torrington Needle Bearing because its high load capacity helps prevent overloading or breakdowns, because its simple, effective system of lubrication allows the bearing to run for long periods without *any* attention at all. And its ready availability helps speed the job of tank production.

WHEN YOU PLAN YOUR POST-WAR DESIGNS, here's something to think about. Your peacetime customers will probably be looking for products that last longer, need less attention, work more efficiently—and the Needle Bearing can help you give them what they want. You will find a long list of typical Needle Bearing applications in Catalog No. 105. One of them may give you an idea for your own product—and Torrington engineers will be glad to help you work out the details.

THE TORRINGTON COMPANY
Established 1866 • Torrington, Connecticut, U. S. A.
Makers of Needle and Ball Bearings
New York Boston Philadelphia Detroit
Cleveland Seattle Chicago San Francisco
Los Angeles Toronto London, England

TORRINGTON NEEDLE BEARINGS

KEYED TO TODAY'S NEEDS

AND TOMORROW'S TRENDS

WHAT'S MY BUSINESS?

It's not manufacturing. It's not construction work. After 23 years, I still have to explain this to people who don't know what we do.

Ours is a firm of consulting management engineers. We don't manufacture machinery, and we don't build buildings.

We do make business surveys for management, directors, bankers or investors to determine the earning possibilities of a company.

We help management in setting up its management program, policies, organization chart and manual.

We assist in devising and installing cost and budgetary controls, compensation plans, and executive reports.

We make market studies and recommend improvements in selling methods.

We assist in the installation or improvement of manufacturing methods, facilities, and organization.

We design and install production control, which includes inventory and material control, planning, scheduling, and dispatching the work.

We make job evaluation studies for factory and office occupations, and assist in their installation.

We advise in the design and development of products, and in the design and development of machinery and tools.

How did I get into this business? It happened in the last World War. I was then in a war production plant. And in that 1916-18 war production drive, I learned this basic fact—

"Labor is just as efficient as Management plans for it and provides tools with which to work."

With that as a premise, I started The Trundle Engineering Company as a consulting engineering firm. The firm grew. We now have offices in New York and Chicago, as well as Cleveland.

★ ★ ★

That is the business I am in. Or, I should say, that is the business our company is in—because I am now only one of over a hundred management engineers in the employ of The Trundle Engineering Company.

Geo. D. Trundle Jr.
President

THE TRUNDLE ENGINEERING COMPANY

Consulting Management Engineering

CHICAGO CLEVELAND NEW YORK

series and are supplied with single cutter blade without a supporting blade. The 4 to 12 in. models are made with a supporting blade, giving added strength to the cutter.

NEW MATERIALS

Dennison Greaseproof Paper Has Crepe Paper Pliability

A No. 1A-35 greaseproof wrapping paper which meets ordnance specifications has been announced by Dennison Manufacturing Co., Framingham, Mass. Its limpness and pliability of crepe paper help it to form and stretch easily around corners and edges, reducing the possibility of tearing and puncturing. After many wrappings the same piece of paper remains pliable and unbroken.

Stewart Mag-Na-Flo Flux Used for Welding Magnesium

Mag-Na-Flo flux for gas welding of magnesium, whether sheet or extrusion, has been brought out by Park Stewart, 1005 Carbis St., Worthington, Pa. It is mixed with water to form a thin paste. The flux is packaged in glass containers and is available in a number of sizes ranging from ¼ to 25 lb.

TRADE PUBLICATIONS

CONTROL DEVICES "Air-Line," a complete catalog carrying detailed descriptive and engineering information of compact devices including circuit breakers, switches, relays, contactors, push buttons, limit switches and special purpose devices is offered by Square D Co., Dept. 24, 4041 North Richards St., Milwaukee, Wis.

CONTROLLERS Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill., has issued 16-page Bulletin Z-6100, giving a condensed listing of measuring and control instruments and covering temperature controllers, remote controllers, combustion safeguard equipment and other instruments.

COPPER Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y., has prepared for manufacturers engaged in war work, a comprehensive guidebook called "Copper Guide," designed to give factual information on copper and copper alloys.

FINISHING Newly developed equipment incorporating the use of surface coated abrasive belts for producing faster and better finishes is described in the booklet offered by the Minnesota Mining and Manufacturing Co., Dept. NR1242, St. Paul, Minn.

GAGES Three new technical bulletins, one describing the SR-4 strain gage and the other two the recording and indicating instruments for use with these gages, have been issued by the Baldwin Southwark Division of The Baldwin Locomotive Works, Philadelphia, Pa.

GRINDERS Operating and engineering executives responsible for the accuracy and finish of ground rolls, cylinders and shafts will find much information of practical value in the 30 pages of Bulletin No. 113 issued by Farrel-Birmingham Co., Inc., Ansonia, Conn.

HARDSTEEL The Black Drill Co., 5005 Euclid Ave., Cleveland, Ohio, has prepared a booklet containing descriptions and illustrations of drills, reamers, tool bits and special tools in war production work.

HEALTH Industrial Relations Section, Department of Economics and Social Institutions, Princeton University, Princeton, N. J., has prepared "Medical Services in Industry," a selected, annotated bibliography with particular reference to health programs in war industries, price 10 cents. "Nutritional Programs for Industrial Employees" and "The Medical Department in War Industries" are also available at 20 cents each.

LIFT TRUCKS "The Inside Story of Towmotor," a manual offered by Towmotor Co., E. 152 St., Cleveland, Ohio, explains what a lift truck really is, what performance can be expected of it and sets up logical yardsticks of comparison enabling purchasers to determine whether the equipment they are considering is most suitable for their particular handling problem.

LIGHTING A 12-page booklet, Serial 2130, prepared by Curtis Lighting, Inc., 6135 W. 65 St., Chicago, Ill., covers types of lighting fixtures for use in industrial plants producing war goods.

MAINTENANCE Forty-one vitally important, commonly recurring equipment maintenance, plant housekeeping and sanitation jobs are covered in a digest issued by Oakite Products, Inc., 24 Thames St., New York, N. Y.

METAL-CUTTING TOOLS "Stellite 98M2 Metal-Cutting Tools for Machining Steel," is the title of Form 5783, a publication listing sizes and prices of standard square and rectangular tool bits and welded-tip tools, issued by Haynes Stellite Co., Kokomo, Ind.

PIPING The American Standards Association, 29 West 39 St., New York, N. Y., announces the approval of the revised 1942 American Standard "Code for Pressure Piping."

PLASTICS A 15-page booklet offered by the Monsanto Chemical Co., St. Louis, Mo., describes briefly the basic

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NE Alloys in Ryerson Stock

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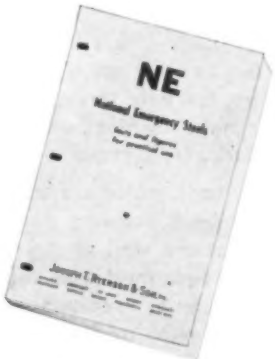
New Technical data—including heat treatment response—is available on NE (National Emergency) Steels. Ryerson tests all NE Steels in stock. This test information is furnished with each shipment of that particular NE Steel. Thus, users can choose which of the lean-alloy steels will best replace the steels of high alloy content previously used.

Jominy End-Quench Hardenability Tests, standard for NE Steels, are a quick, reliable method of determining heat treatment response. How this test is made, the results obtained, and how to interpret hardenability in terms of tensile strength, yield point, elongation, and reduction of area, are clearly told in a recent Ryerson publication on NE Steels. Copies are available—call or write your nearby Ryerson plant.



A HANDBOOK ON NE STEELS New, complete, authoritative! Compiled by Ryerson. If you are adapting NE Steels to your production and haven't a copy, ask for one today!

Representative stocks of NE Steels are available at Ryerson for prompt shipment. Turnover is rapid; withdrawals are heavy, but new stocks are constantly being received. Ryerson engineers and metallurgists will gladly answer any question you may have and help you get started with NE Steels.

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Winter Styles for American Pilots

AMERICAN flyers have the best of everything regardless of cost — and that is exactly as it should be. Nothing is too good for our flying, fighting men.

The policy of providing the very best reaches through every branch of industry, for only through superiority of our men, machines and equipment can victory be secured.

Fenn tool makers, machinists and engineers are building machines and parts that are vital to the war drive. Civilian needs must wait until this job is done; then Fenn can once more turn its facilities to peace time service.

Fenn acts as prime contractor or sub-contractor on Special Machinery, parts and equipment. We welcome inquiries from those who need assistance in either development work or actual production.

FENN

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types of plastics, their possibilities and limitations, and illustrates a few of the war jobs they are now filling.

PLASTICS Methods of fabricating "Lucite" methyl methacrylate resin into airplane enclosures and other products are described in detail in the illustrated manual on "Lucite" for Aircraft issued by the Plastics Dept., E. I. du Pont de Nemours & Co., Arlington, N. J.

PRESSES Semi-automatic toggle-type compression presses, also single punch and high-speed rotary preforming presses for the plastics industry are illustrated and described in 15-page catalog No. 427 published by F. J. Stokes Machine Co., Olney P.O., Philadelphia, Pa.

TRAINING Samples of training programs now in operation in war production industries and many exhibits illustrating the material used in such programs are included in "Training Employees as Job Instructors," a handbook of training principles and practices issued by Policyholders Service Bureau, Metropolitan Life Insurance Co., 1 Madison Ave., New York, N. Y.

NEW BOOKS

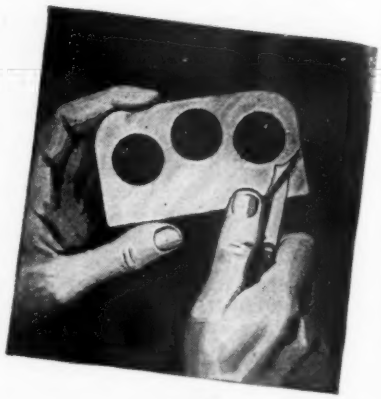
LUBRICATION—*Edited by J. R. Muenger, formerly assistant in mechanical engineering, Harvard University, and written by Arthur Edwin Norton, the late Gordon McKay Professor of Applied Mechanics, Harvard University.* 244 *pages. Published by the McGraw-Hill Book Company,* 330 *West* 42 *St., New York, N. Y.* $3.

The necessary brevity of most technical papers, plus the variety in nomenclature and method of presentation, makes it difficult to begin a study of lubrication without a text. This book was written to satisfy this need.

The major part of the book is concerned with the hydrodynamic theory of bearings. This is developed from the simple concepts of viscosity and equilibrium, rather than from the differential equations of hydrodynamic for motion and equilibrium. Equations for the performance of various types of bearings are developed. Derivation of these equations requires the use of integral calculus, but the results are given by simple algebraic equations, which have form similar to the various types of bearings and which contain numerical factors. These numerical factors are presented graphically in the text.

Besides presenting the hydrodynamic theory, the book discusses the types of friction of interest in lubrication, and gives criteria for bearings. A chapter is devoted to properties of lubricants. Viscosity, its measurement and its variation with temperature are discussed at some length. Design practices, in-

save



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THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

cluding grooving, bearing metals, and methods of applying lubricants are discussed. A comparison of plain bearings with roller contact bearings is made. Numerical examples of the solution of typical problems are presented. Numerous references are listed in the appendix for those who wish to make an intensive study of any phase of the subject.

•

READING AIRCRAFT BLUEPRINTS—*Francis L. Goff and Lloyd R. Novak, aeronautical engineers, McDonnell Aircraft Corp., St. Louis, Mo.* 76 *pages and* 50 *blueprints. Published by McKnight & McKnight, Bloomington, Ill.* $2.

This book has been prepared for anyone who desires to understand the principles and practices set forth on aircraft blueprints in use today. The material covered is divided into five parts which, along with the appendix, cover all the fundamentals of aircraft blueprint reading.

Part I consists of a three-view print of the airplane which is used for all the material covered in this book. In addition, there are four other blueprints of major units of the plane, with explanatory material.

Part II has 23 blueprints of sheet-metal parts typical of those being designed for and used in the construction of today's aircraft. Each of these sheet-metal parts is a part of the complete airplane in blueprint 1. Although only a few of the hundreds of sheet-metal parts which make up the airplane are included here, most of the principles and practices involved are covered on these prints.

Part III includes seven blueprints of standard aircraft parts which are in common use. These prints give the student necessary information regarding the use of both Army-Navy (AN) standards and company standards.

Part IV is made up of ten blueprints of forged castings and machined aircraft parts.

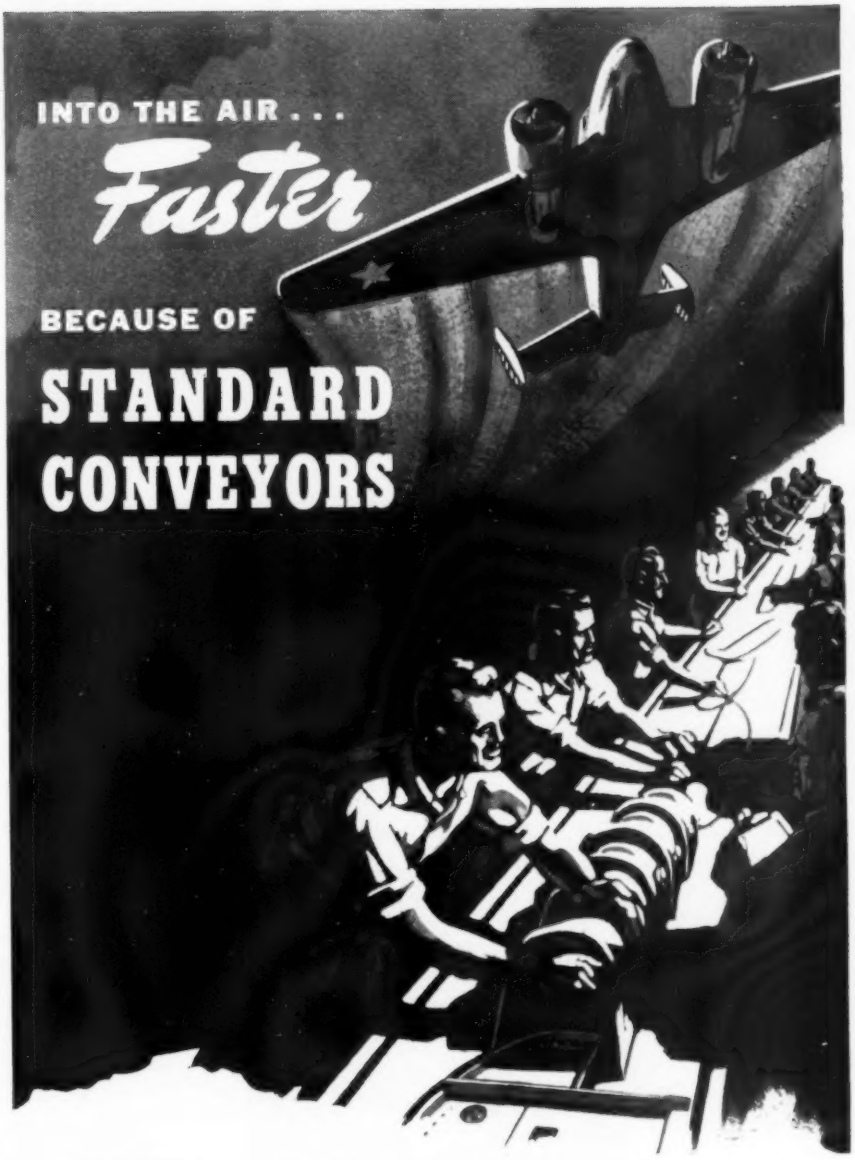
Part V consists of five assembly blueprints. These cover minor assemblies typical of those in use in industry.

There is an appendix containing reference material to help in the study of definitions of new words and other material new to students. Each blueprint is accompanied by explanatory material, instructions and pertinent questions.

•

AIRCRAFT DETAIL DRAFTING—*Norman Meadowcroft, service engineer, Douglas Aircraft Company, Inc., Santa Monica, Calif.* 211 *pages. Published by McGraw-Hill Book Company, Inc., 330 W.* 42 *St., New York, N. Y.* $2.25.

This text is an amplification of a course entitled "Aircraft Drafting Standards," presented at the University of California at Los Angeles to workers employed or employable in the aircraft industry. The course is intended



BOMBERS and fighters—death-dealing American war birds—get into action faster because Standard Conveyors help to speed production of units and parts in scores of America's aircraft plants.

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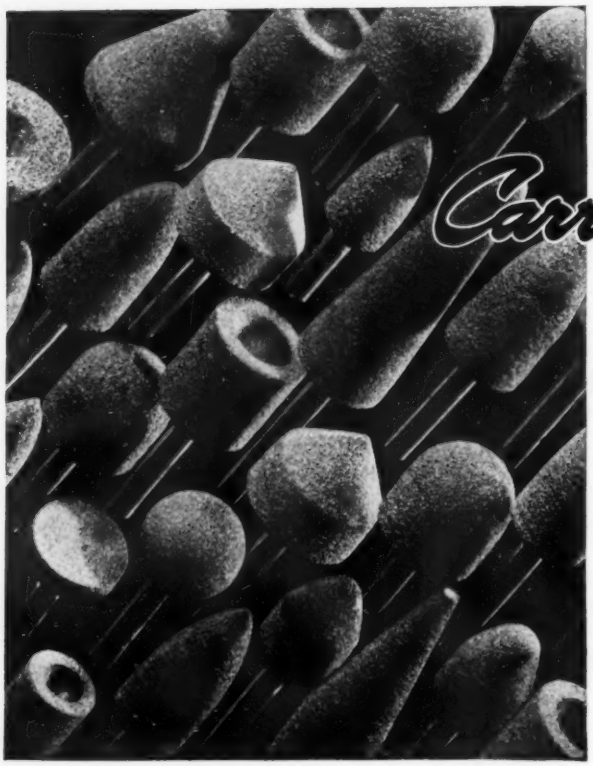

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FINISH THE JOB RIGHT

Like setting the last rivet as the plane comes off the production line—burring, finishing and polishing to minute specifications mean the job is right.

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to be a transition course for young men who already have had training in some branch of engineering, but desire knowledge of specific phases of aircraft drafting. Much attention is given to offering a student a knowledge of the materials and processes used in aircraft contsruction.

Much information has now become standardized among the aircraft manufacturers, and this standard information is given throughout this textbook. Practical examples from aircraft construction are also given, and the drafting assignments presented by the author cover production drawings of typical airplane parts.

The book not only covers standard drawing practices, as applied to the aircraft industry, but also gives data on the strength-weight ratios of materials used in aircraft construction. The latter includes data on aluminum alloys, die castings, aircraft steel forgings, and castings. Standard procedure for layout of drawings, including sizes, zoning, numbering and lettering are included. Standard drawing data are included to show practices for indicating screw thread forms, rivets, bolts, pins, and tolerances, limits and fits. The book is intended to give a full understanding of the fundamentals of aircraft detail drafting with which a student can advance rapidly to aircraft layout and detail design.

Filing Machines and Methods

By JOHN E. HYLER

Many are the advantages which come with machine filing. The machines may be divided roughly into three classifications: rotary, reciprocating and band.

In many different types of irregular work rotary filing machines are adaptable for finishing curves and cavities or in locations where there is no room for hand filing. The prime requisites of such machines are lightness and ease of handling; these limit fatigue in manipulation.

The better types of flexible shaft machines used for rotary filing are equipped with some sort of multi-speed arrangement that varies the file as conditions indicate. Electric welds, annealed carbon tool steel, and hard cast iron may be filed at about 20 surface ft. per min. when using high speed steel files. But for softer materials, like brass and aluminum, the tool may be speeded up to 500 or 60 surface ft. per min. Rotary rasps are available for use on bone, horn, fiber, ivory, leather, rubber and other materials.

Although rotary files have found wide application on tools, dies, templets and irregular production shapes such as stove grates, there are some classes of work where a reciprocating file, that can be guided to the work freehand, has been found a better tool. There is on the market an air drive

INEXPERIENCED HANDS

Can't Damage THIS MACHINE

It Has

VICKERS HYDROMOTIVE CONTROLS

Representative of More Than 5,000 Standardized Vickers Units for Every Hydraulic Power and Control Function

The tremendous occupational shift from the manufacture of civilian goods to materials necessary to win the war need give the design engineer no concern . . . if he equips his machines with Vickers Hydromotive Controls.

Vickers Hydromotive Controls are your best insurance against abuse of equipment by the inexperienced hands of the hundreds of thousands of men (and women) who will soon operate metal-working production machines for the first time. Vickers Control Circuits provide positive and automatic overload protection for the machines to which they are applied; exact load limitation on these machines can be predetermined and accurately maintained. Operation controls are so interlocked that the work cannot be damaged.

Vickers Application Engineers will gladly discuss with you individual problems of improving machine controls.

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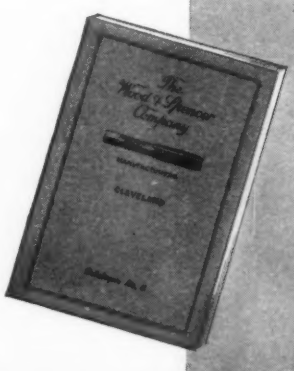
"USE TOOLS CAREFULLY *and* INTELLIGENTLY"

By doing so, you can get maximum work . . . maximum quality . . . maximum life from the well built tools you use. Too, by PICKING THE *RIGHT* TOOL, and KEEPING IT IN CONDITION, you can contribute valuably to the Nation's war effort and ultimate Victory.

Let us help you select the right tap for your job.



FROM CUSTOMERS' BLUEPRINTS WE QUITE FREQUENTLY MAKE RECOMMENDATIONS FOR

"THE RIGHT TAP AT THE RIGHT TIME"

The Wood & Spencer Company
Cleveland, Ohio

tool, fitted with a trigger valve, which will drive a small file at speeds varying between 500 and 5,000 strokes per minute. This tool is of pistol type, will accommodate different shapes of quickly interchangeable files and the speed is governed by the amount of air admitted by the trigger valve. Where surfaces are required to be relatively straight in one direction such a file will be much better than a rotary unit, and small sharp corners may be worked out that could not be reached with a rotary tool. Another highly efficient reciprocating file is made in a portable electric model.

In working aluminum, brass and similar soft metals, comparatively soft tempered bandsaw blades are used that may be filed when re-sharpening is in order. One manufacturer furnishes special models of bandsaw filers for such blades.

Vertical filing machines are used by makers of dies, for filing the openings in dies for blanking, etc. One machine of this kind, suited also to production work, is very readily set up, and the design is such that the work may readily be removed for inspection, and then returned to the machine table, without disturbing adjustments. One bench versatile die filing machine will accommodate the use of machine files, hand files, saws or stoning files. One make of die filing machine has incorporated a universal joint file clamp, by means of which compensation may be made for any deviation from truth which may be present in file shanks.

There is an advantage in having a die filing and sawing machine with a table of the proper size to accommodate the average work handled. One builder of these machines furnishes them with tables of different sizes. Such machines may be used in final lapping operations, as well as sawing and filing.

Closed bottom dies may be filed to advantage on a special line of die filing machines which incorporate an independent overhead support for the files. They can also be used on standard die filing and on a great amount of other work. They are particularly suitable for experimental departments and shops which are in the habit of making up a test or proof model of different lines to be produced.

Refined Quality Control—Correction

In "Refined Quality Control," (*AM*—Vol. 86, page 1431, 1432), appeared certain errors. In Figure 1, symbols shown as O' should have been σ', while in diagram *B*, the symbol $\overline{X}$ should have been $\overline{X}'$. On page 1432, column 1, line 9, the first symbol X should have been $\overline{X}$, and in the formula for σ, given farther below, the value $(X_n - \overline{X})$ in the numerator should have been in parentheses. The formula which appears in the middle of column 1, on the same page, should read $R = X_{max} - X_{min}$.

More Power per Pound

HANDLE
Steel air vents on top and bottom, pressed in housing, assure ample ventilation.

FIELD HOUSING
Steel inserts for housing assembly screws cast into plastic for permanency.
Steel commutator end bearing insert cast into housing. Also serves as ground connection for drill.

GEAR CASE COVER
3 steel bearing inserts welded in cluster are permanently cast in plastic to stand maximum stress.

GEAR CASE
Steel spindle bearing insert and steel intermediate bearing insert permanently cast in plastic housing.

in the New Black & Decker "Drillite" Plastic Drill

BLACK & DECKER Engineers have done it again! A husky, new, lightweight drill with the *highest horsepower per pound of any drill ever produced by Black & Decker.* The housings of these 1/4" Standard and 3/8" Standard Drills—made from the modern new plastic . . . DRILLITE—were exclusively developed and perfected by eye-to-the-future Black & Decker Engineers. DRILLITE PLASTIC makes these tools a full pound lighter in weight—yet exhaustive tests prove they stand up under hard, continuous running.

DRILLITE is a perfect insulator against dielectric shock, makes the drill cooler to handle, has high impact resistance. Screened air inlets insure ample ventilation. Handsome black finish provides lustrous, modern streamlined appearance.

Ask your nearby Black & Decker Distributor for complete specifications on the Electric Drills of Tomorrow! The Black & Decker Mfg. Co., 716 Penna Ave., Towson, Md.

LEADING DISTRIBUTORS EVERYWHERE SELL

4 New Models OF BLACK & DECKER "PLASTIC" DRILLS

Black & Decker

PORTABLE ELECTRIC TOOLS

3/8" STANDARD DRILL with End Handle Weight.....5¾ lbs.

1/4" STANDARD DRILL with End Handle Weight.....4¾ lbs.

3/8" STANDARD DRILL with Side Handle Weight.....5⅝ lbs.

1/4" STANDARD DRILL with Side Handle Weight.....4⅝ lbs.

Keep your machines constantly ahead of Victory demands; use Timken Bearings at every suitable bearing position. Then they'll do a better post-war job, too.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

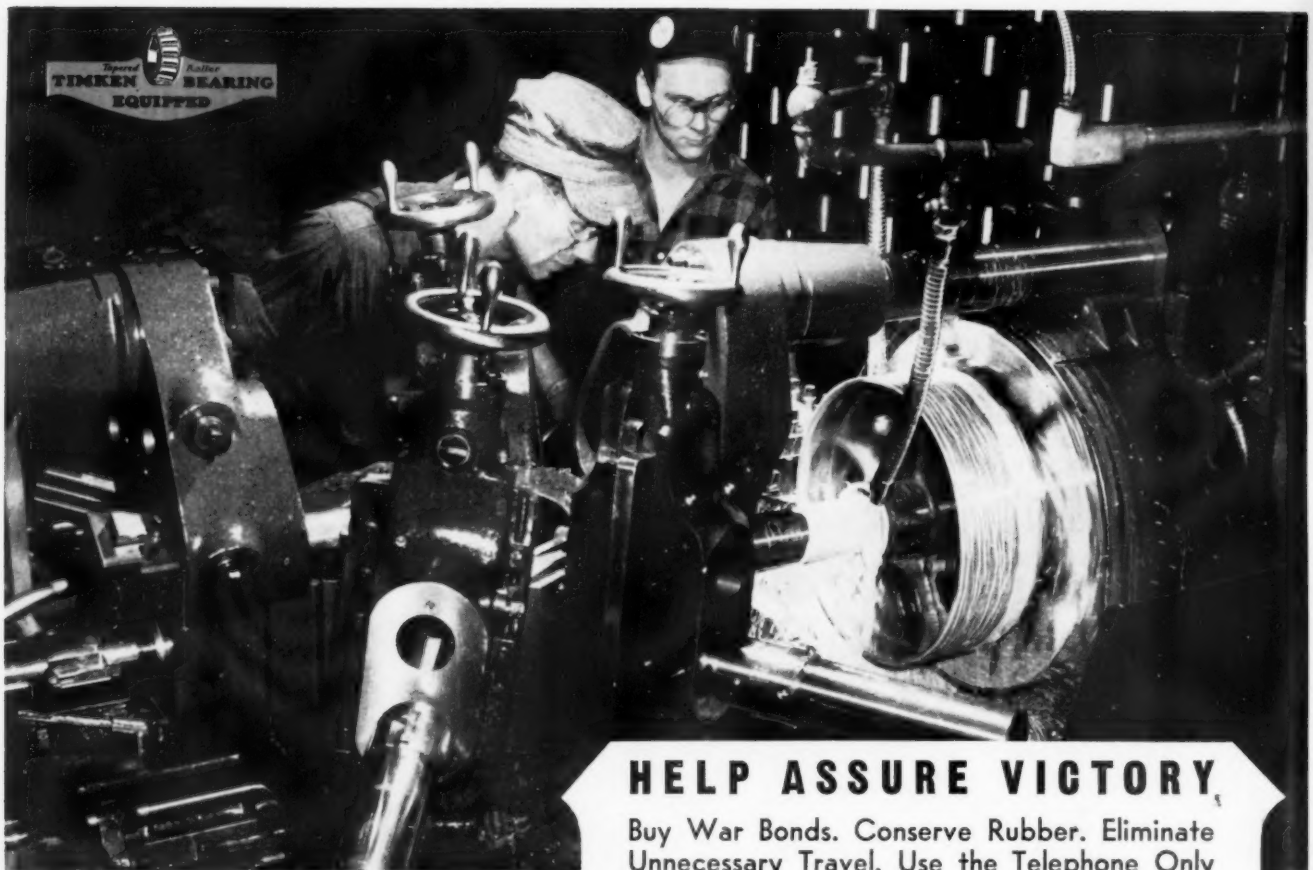
"All There Is In Bearings"

Timken Tapered Roller Bearings possess everything required of bearings in all kinds of machines; ability to eliminate friction; to minimize wear; to carry radial, thrust and combined loads; and to maintain moving parts in constant alignment.

Naturally, the more Timken Bearings any machine contains, the greater the protection it receives and the more efficiently it performs.

The engineer who realizes this and acts accordingly, not only gives his company *better* machines, but likewise *better selling* machines because the trade-mark "TIMKEN" is a universally accepted guide to superiority.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO



Warner & Swasey No. 3-A Turret Lathe equipped with Timken Bearings performing the first machining operation on structural nickel steel tank wheels.

HELP ASSURE VICTORY

Buy War Bonds. Conserve Rubber. Eliminate Unnecessary Travel. Use the Telephone Only When Important. Salvage All Scrap and Waste Material.

All Timken Bearing production now goes into fighting machines. However, the Timken Bearings in your motor vehicles or industrial machines will see you through the emergency—and beyond it—if you make sure they are lubricated and inspected regularly.

Cut Recruit Training Period of Your Screw Driver Army

ANYONE CAN DRIVE PHILLIPS SCREWS!

In many of today's war-expanded plants, *raw recruits* now literally walk from the employment office into responsible screw-driving jobs previously rated as skilled work. They produce efficiently, too, because the job is simplified and made foolproof by Phillips recessed head Screws.

The Phillips driver centers *automatically* in the recess . . . can't slip out to injure hands or spoil the work. This means centered *driving force* . . . no fumbling, wobbly starts . . . no slant-driven screws . . . no burred or broken screw heads.

Snug fit and perfect centering of driver in the Phillips Recess enable workers to make *uniformly tight* fastenings . . . and do it with *less effort*. Driving speed is often *doubled* because easy-driving, skid-proof Phillips recessed head Screws make power-driving practical!

They cost less to use! Compare the cost of driving Phillips and slotted head screws. You'll find that the price of screws is a minor item in your total fastening expense . . . that it actually costs less to have the many advantages of the Phillips Recess!

KEY TO FASTENING SPEED AND ECONOMY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

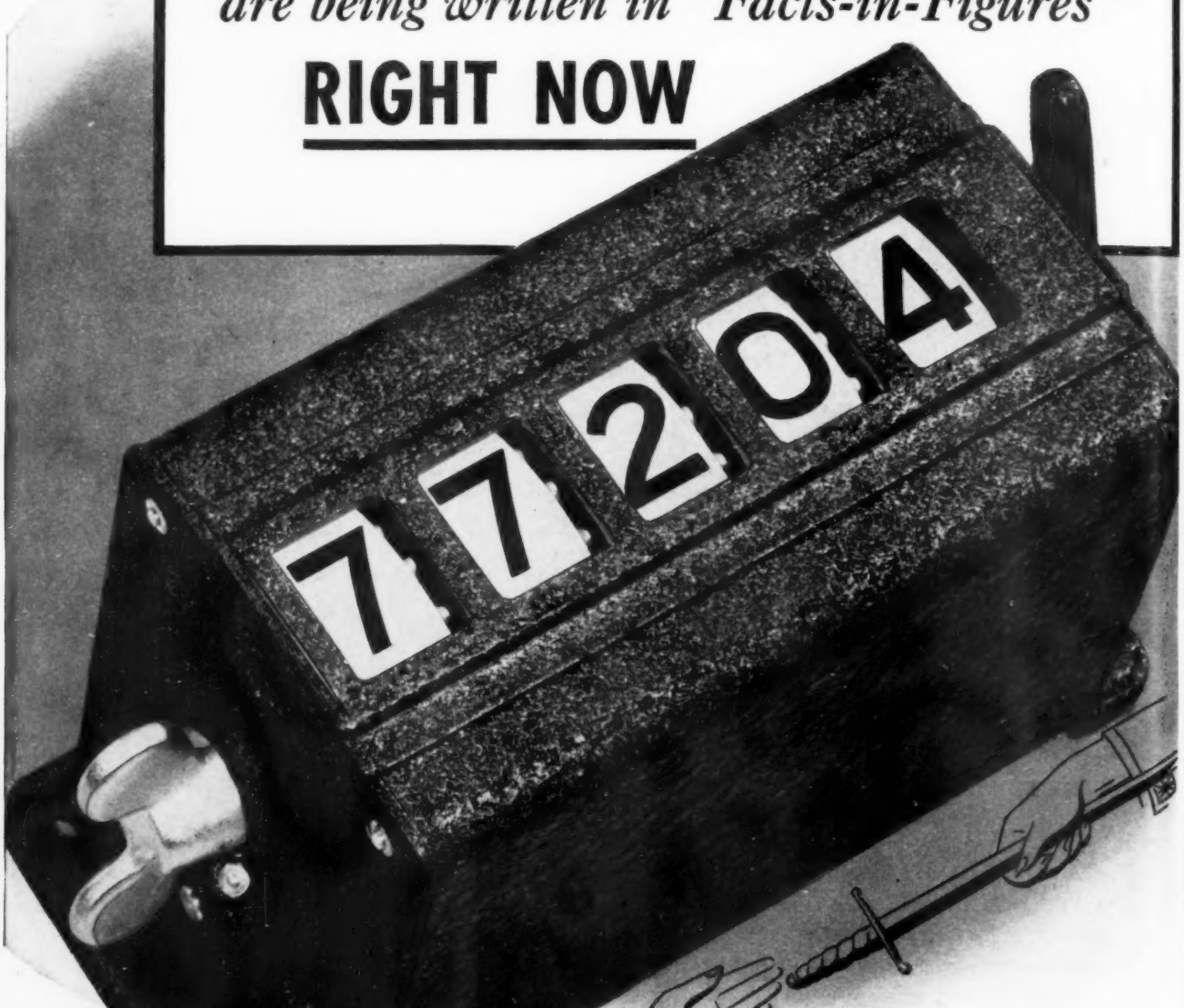
21 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Reading Screw Co., Norristown, Pa.
Pheoll Manufacturing Co., Chicago, Ill.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

PEACE TERMS

are being written in "Facts-in-Figures"

RIGHT NOW



Veeder-Root

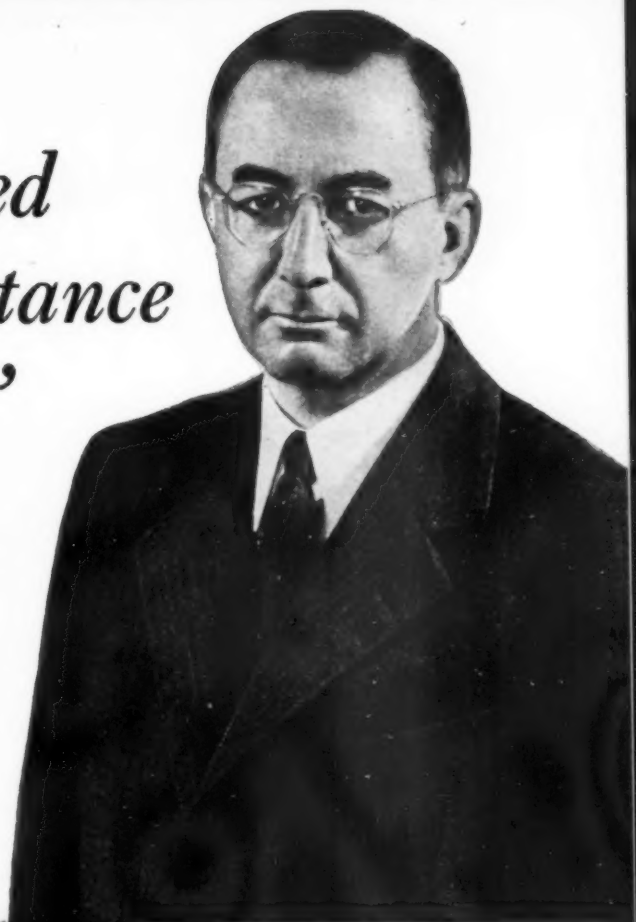
INCORPORATED

The Counting House of Industry

The length of the war and terms of the peace are being forecast *today*, in plain black-and-white, by American production machines . . . in hourly and daily facts in figures supplied by Veeder-Root Counting Devices. This accurate "current history" of production eliminates the confusion and uncertainty that cuts down speed and efficiency where no count is kept . . . prevents over-runs and shortages . . . improves interdepartmental co-ordination and timing. All of which is a solid contribution toward one end . . . *a quicker end to this war*. So if your work counts importantly in the War Effort, find out how Veeder-Root can help you make it count to the utmost.

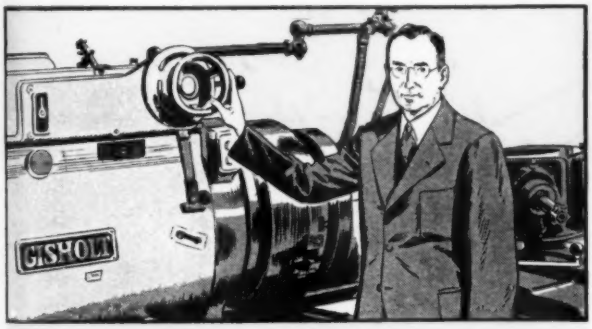
MACHINE TOOL TIPS FROM THE TOP-NOTCHERS—#1

"Correct cutting speed is of the utmost importance in metal turning"

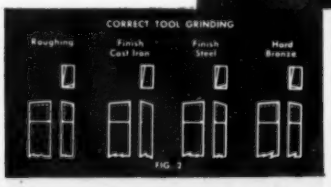


says GEORGE M. CLASS
Vice-President in Charge of Engineering
GISHOLT MACHINE COMPANY
Madison, Wisconsin

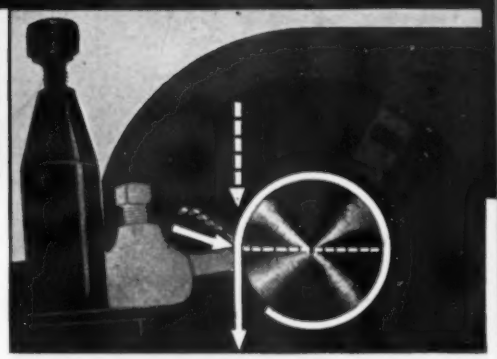
Latest Gisholt contribution to the war effort is the new Heavy-Duty Turret Lathe with time-saving Gisholt Speed Selector, which is helping American industry "MAKE IT FIT TO FIGHT."



"SELECTING THE PROPER TOOL to cut a specific kind of material is only part of a cutting operation. For the best results the machine should be operated at correct cutting speed. To select this speed properly, it should be kept in mind that the faster the rate of the cutting speed, the closer you approach the speed at which the cutting tool actually *cuts* the metal and does not just push it off the part being machined.



"TO ACHIEVE the desired clean cut, the tool used should be ground at regular intervals (Fig. 2 above). A good rule to follow is: the cutting speed for roughing tools should be maintained at a rate resulting in approximately a 4-hour tool life between grinds; with a tool life of from 8 to 12 hours between grinds for finishing tools.



"IT IS ALSO TRUE that the faster the cutting speed the better the finish on the work. For at the point of speed where the tool actually cuts the metal, in place of pushing it off, a very smooth finish will be produced. Always run as fast as the tools and the design of the work will permit.

"IT IS ALSO DESIRABLE to use a cutting lubricant that not only will keep the work and tool cool, but also will lubricate the cutting edge of the tool. This allows the chip to slide more freely over the top of the tool, thus producing a better cutting action and allowing an increase in cutting speed."

The correct cutting oil is as important to proper machine tool operation as the correct cutting speed. That's why Shell has developed a control technique that "balances" the oil to the machine, the application and the tool. Call in the Shell man now for details.

SHELL

SHELL LATA OILS
FOR METAL WORKING

FLASH Welding?

HERE is the first of Progressive's new standard line of flash-welders, a 150 KVA machine available either for conventional manual operation or with the spectacular new "Flash-trol" monitor which automatically controls the rate of feed to prevent short-circuiting of the welding arc.

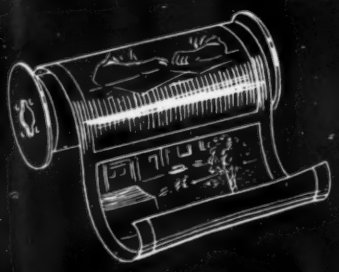
Ask for Bulletin No. 201

PROGRESSIVE WELDER CO.

SEAM, PROJECTION & BUTT • Electric Welding Equipment • PORTABLE GUN & PEDESTAL

3050 E. OUTER DRIVE DETROIT, U.S.A.

FORGING DIES



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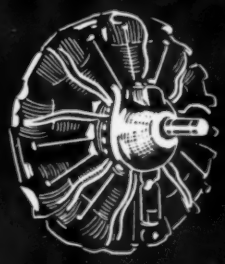


AIRPLANE ENGINE

CATHODE RAY TUBE

"dag" COLLOIDAL GRAPHITE

IS IMPORTANT in the Manufacture or Use of these Products

HERE ARE THE RULES

Acheson Colloids Corporation will give a $25.00 War Bond to each of the 5 people who submit complete and accurate answers together with the 5 best letters on the question, "Why is **"dag"** colloidal graphite important in the manufacture and/or use of the products pictured here?" (1) State business connections (no one in the graphite field or their families will be eligible). (2) All entries must be legible. (3) All entries must state the publication in which the advertisement was seen. (4) Entries must be postmarked not later than April 15, 1943. (5) In case of ties, duplicate awards will be made. (6) Entries become the property of the Acheson Colloids Corp. (7) The verdict of the judges will be final.

"dag" COLLOIDAL GRAPHITE FOR TREATING SCREW THREADS

Screws and bolts which have long been in place are often extremely difficult to remove, especially if the assembly of which they are a part has been exposed to heat, moisture, or the action of certain corrosive chemicals. In many cases they cannot be removed without being destroyed.

Typical examples of this are bolts, studs and nuts on engine manifolds and turbines, pipe, spark plugs, set screws used in large clothes pressing irons, etc. Likewise, electric lamp bulbs, subject to salt spray or chemical fumes, stick in their sockets so tightly they cannot be removed without breaking.

The time and effort used in removing frozen screws can be saved by treating the threads before assembly with "dag" colloidal graphite. This material provides the necessary lubrication to reduce static friction between screw threads and to permit the removal of the screw with a minimum of effort. "dag" colloidal graphite is a lubricant which is not destroyed by the action of heat and which in some cases exhibits anti-corrosive properties.

Screws and bolts treated with "dag" colloidal graphite may be drawn up tighter and with less effort than they could be otherwise. Such treatment is the only practical way of keeping anodized aluminum screw threads easily workable.

Write for NEW BULLETIN 430E
on "dag" Colloidal Graphite—Its Importance to Modern Industry

ACHESON COLLOIDS CORPORATION

PORT HURON • MICHIGAN

dag COLLOIDAL PRODUCTS

McCASKEY TOOL CRIB CONTROL

provides a practical way to obtain . . .

MORE PRODUCTION* WITH LESS TOOLS**

Time for tool crib transaction reduced almost 75%. *The works accountant in a modern plant reports as follows: "Previous to the McCaskey installation, a time study disclosed that a tool crib transaction was completed in 1.24 minutes. Similar time studies reveal that a transaction is completed in 20 seconds in the McCaskey equipped crib." Minutes saved at the crib mean hours gained in production.*

A $2000 Windfall

The general superintendent of a large manufacturing plant writes, "One of the first results of the plan (McCaskey Tool Crib Control) was the turning in of $2000 worth of tools, virtually a windfall, so far as practical use was concerned."

★ NO DELAYS AT THE TOOL CRIB WINDOW

Faster service at the crib window is assured by McCaskey Control. Tools are located instantly whether in the crib or *on the production floor.* Responsibility for tools drawn is quickly and definitely fixed, eliminating time-killing and irritating disputes about tools returned. Numerous other savings of time frequently lost at the crib add up to *more productive hours* for men and machines—to the increased production so essential today.

McCaskey procedure is exceedingly simple. Speedy service is not dependent on memory and it enables even inexperienced attendants to do an effective job—most important now, when experience is at such a great premium. McCaskey Control is proving particularly practical also in handling today's multi-shift operations in hundreds of installations.

★★ NO "HOARDING" OF TOOLS NOT IN USE

With McCaskey, tools are kept in circulation preventing their accumulation in employees' tool boxes or around machines. Loss and theft of tools are likewise minimized as well as breakage. Hidden records encourage "hoarding" of tools that should be available for the use of others; the complete visibility of McCaskey prevents it almost automatically. McCaskey dated records tell at a glance how long tools have been out, indicating the ones that should be returned.

This constant check on tool availability, on where and how long they are in use, and other desirable features are enabling hundreds of plants to maintain high production with fewer tools. The danger of production delays from tool shortage is vastly minimized.

A McCaskey representative is available to render valuable assistance in helping you attain more production with less tools. Write for this assistance, *NOW.* No Service fee. No obligations.

McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

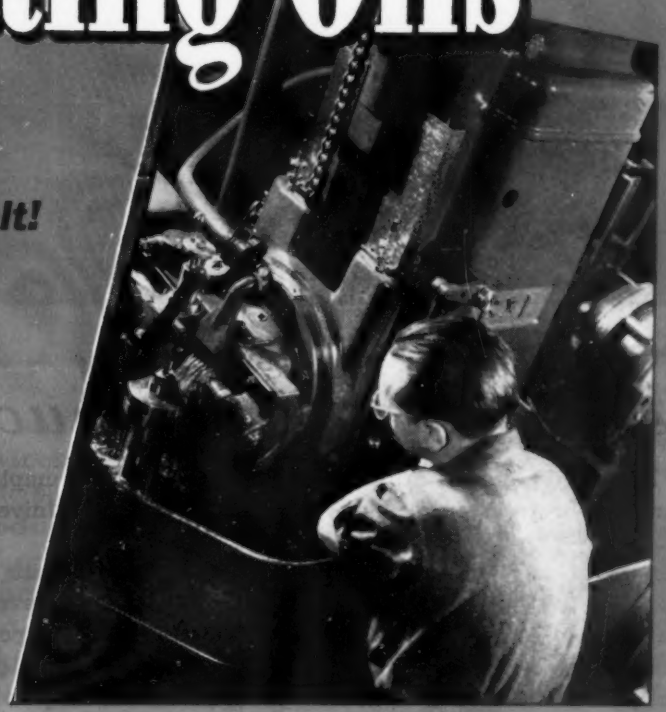
McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

Increased Production

with **Gulf Cutting Oils**

is the *usual* result!



Let a Gulf Lubrication Service Engineer demonstrate how these quality cutting oils can improve your machining practice.

UP to 100% greater production, up to 1000% longer tool life, better finishes on the work —these are the results obtained with Gulf Cutting Oils in plant after plant.

Engineered for the production requirements of *today*, Gulf Cutting Oils combine the best possible lubrication and effective cooling in the cutting and tool-chip contact areas. In practically every case, machine tool performance and work finish are greatly improved with these specially prepared cutting oils on the job. Improved chip quality and shape reflect improved cutting to experienced operators.

Let a Gulf Lubrication Service Engineer demonstrate — in *your* plant — how Gulf Cutting Oils can help you get improved machining practice and increased production.

For additional information on Gulf Cutting Oils, send the coupon below.

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company AM
3800 Gulf Building, Pittsburgh, Pa.

Please send me, without obligation, a copy of the new booklet, "Gulf Cutting Oils," which includes a 24-page Machining Guide.

Name .....

Company .....

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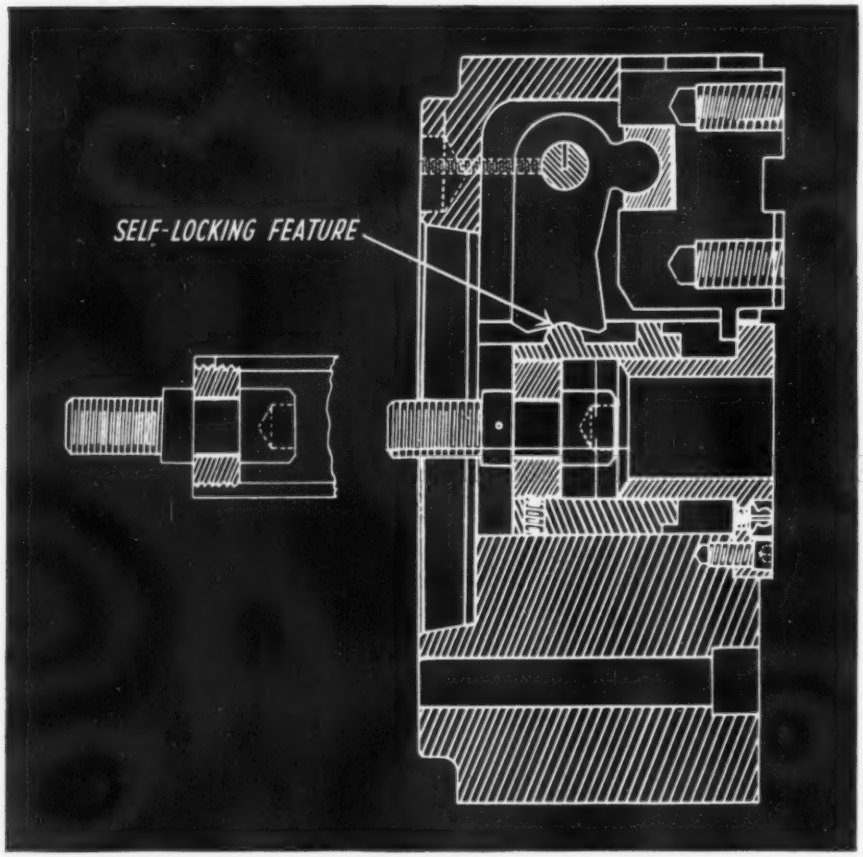
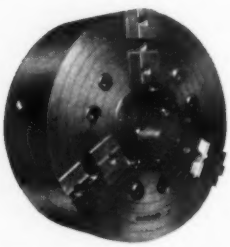


A Different Air Chuck

Self-locking both ways—double-gripping power—lower air consumption! These are among the features of Anker-Holth Air Operated Universal Three Jaw Chucks—*the air chucks that are different.*

The exclusive design of Anker-Holth chucks permits heavier cuts and coarser feeds. The wedge action of the cam on the bottom of the levers—operating in both directions—more than doubles the gripping power obtained through leverage alone. The jaws lock securely, whether gripping externally or internally. Work is held tightly, should the air pressure drop or be cut off entirely.



Self-locking, double-power, three jaw "Airgrip" chuck—by Anker-Holth Mfg. Co.

Anker-Holth Air Chucks give you more power when you need it. And, that extra power means you can reduce air consumption by using smaller cylinders.

It will be worth your while to know more about the Anker-Holth line of high speed rotating air cylinders that permit high spindle speeds; air operated collets and expanding arbors; and, air filter, automatic lubricator, and regulating valve units.

IMMEDIATE DELIVERY—3" to 14" AIR CYLINDERS!

Anker-Holth Mfg. Co.

"AIRGRIP" CHUCK DIVISION

332 So. MICHIGAN AVE. • CHICAGO, ILL.

HOW TO convert plants and produce more and better war goods

HERE IS YOUR KEY to the problems of getting war production contracts, converting quickly and effectively to war production, and meeting wartime requirements for faster, better output. It brings you practical information in tips on threading the complexities of conversion and procurement, check lists of things to do and not to do, pointers on relationships with the government, and fundamentals, methods, and suggestions in profusion, for planning and controlling production, improving operations, and bringing your plant up to the efficiency required.

JUST PUBLISHED

HANDBOOK OF WAR PRODUCTION

By EDWIN ARTHUR BOYAN

Research Associate, Department of Business and Engineering Administration, Massachusetts Institute of Technology

368 pages, 6 x 9, price only $3.00

THIS handbook shows how to get best results in problems specifically associated with the war effort—arranging contracts, subcontracting, procuring materials and supplies, estimating, converting the plant, etc. It also covers planning and control, labor, inspection, salvage, industrial accounting, and other production factors ordinarily important to the manufacturing enterprise, giving the pointers and methods especially vital under wartime conditions and requirements.

Gives such practical helps as:

—over-all approach and technique to follow in the maze of contracts and relationships that must be developed in contract procurement
—pointers on determining nature of government requirements, how to handle bids, reasons for failure to get contracts, etc.
—major steps to be taken in conversion
—concise treatment of work simplification, including lists of 300 questions that indicate points for improving processes and operations
—duties of a priorities division; place in the organization; simple technique for follow-up of promises by supplier
—pointers on handling supervisory training, training on the job, and personnel policies
—how to determine what and how much inspection is necessary
—suggestions for cooperating with government inspectors
—how to set up and operate practical salvage systems
—example of careful and rapid bid development method etc., etc.

Based on tested methods

Valuable information secured in direct contacts with numbers of successful war production plants is here organized and presented in a form to give you a quick view of the fundamental problems—the technique of approaching them, getting information specific to your own plant and making use of it—and many practical methods for direct application.

EDWIN H. SCHELL says in the Foreword: "It is a working tool which the manufacturer may put to immediate use when undertaking production for the nation."

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SEND THIS COUPON

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Send me Boyan's Handbook of War Production for 10 days' examination on approval. In 10 days I will send $3.00, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

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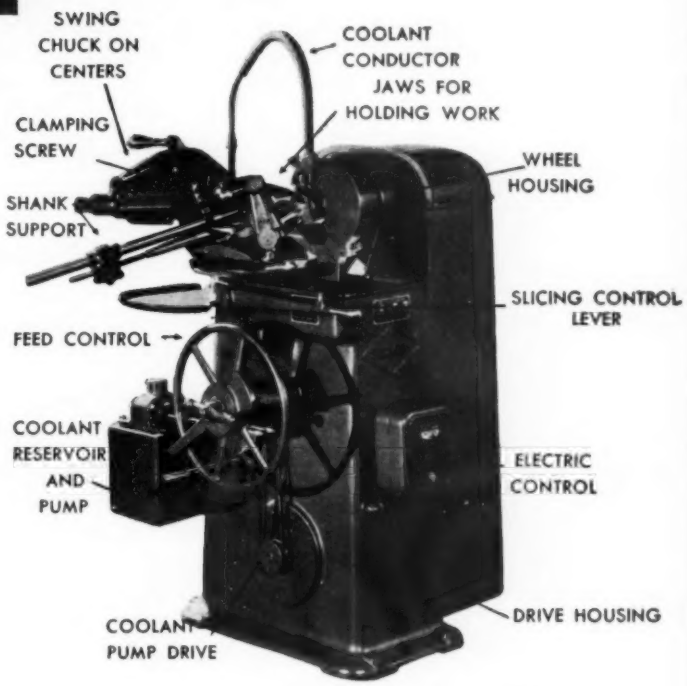
The GIRL and the GRINDER

MARGARET HOPSON *operates a Model 6-G Sellers Drill Grinder. Operation and control levers are so simple and the automatic location of the point and the angle of the cutting lip so positive that she has no difficulty in grinding perfect drills — from the tiny ¼" size to the big 3" drills she is working on.*

Releasing needed manpower for our 7,500,000 Army (and for all the other Services) Girls in Industry are rendering a patriotic service that will not be forgotten. For the production lines of U. S. industry must not slacken . . . must, in fact, be speeded up, and at the same time all possible manpower must go into our armed forces. Girls in Industry are making this possible . . . and tools like Sellers Drill Grinders are helping.

Drills are a vital factor in production, and Drill grinding therefore is a daily necessity in all large plants. Fast, accurate drill grinding insures clean round drilled holes and prevents production delays. The simplicity of the Sellers Drill Grinder makes it possible for these girls to grind the largest as well as the smallest drills to precision accuracy and with a speed that is astonishing.



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The firm of SWAN-FINCH had its beginning 90 years ago in crude lubricants of that era.

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LUBRICATION SPECIALISTS

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Thru four American Wars;—*nine decades* of cumulative research and experience as lubrication specialists for highly engineered industries.

Today SAFCO Metal Working Lubricants are helping materially to establish greater production records—devising new ways and means to meet exacting demands for greater speed—INCREASED PRODUCTION!

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Ask to have our field representative call.

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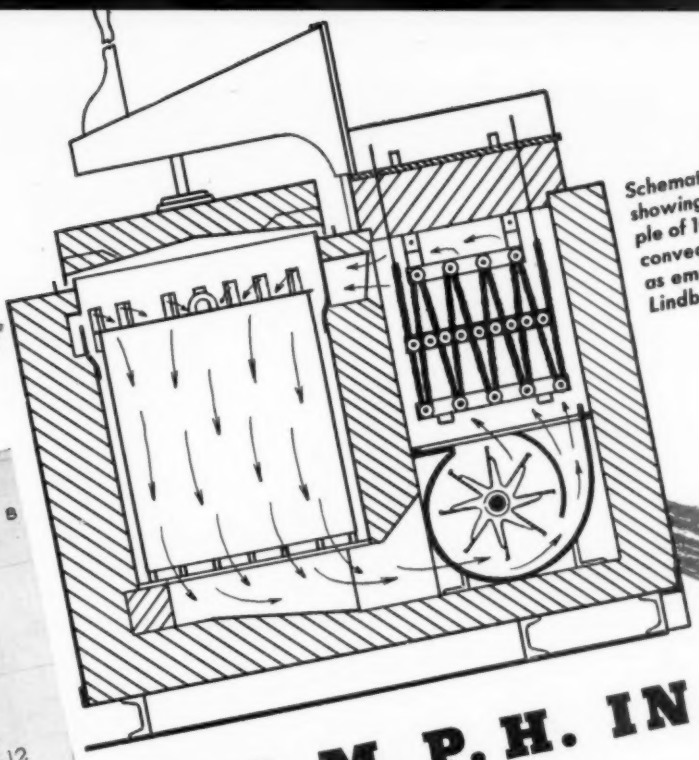
CYCLONE



Schematic drawing showing the principle of 100% forced convection heating as employed in the Lindberg Cyclone.

100 M.P.H. IN A 5° GROOVE!

Evidence of accurate heating—a typical Cyclone control chart.

A typical load of aluminum castings which are heat treated daily, and with consistent uniformity, in Lindberg Cyclones all over the country.

STARTING at a cyclonic speed of 100 miles per hour, heated air is driven, by a large, powerful, dynamically balanced fan of Lindberg design, through the charge of the Cyclone Furnace, soaking each piece in an accurate, uniform heat, which is precision controlled to ± 2.5° of the desired temperature.

PIONEERED BY LINDBERG

This 100% forced convection heating principle of the Cyclone Furnace, pioneered and developed 8 years ago by Lindberg engineers, is employed today by all the leading aircraft manufacturers and subcontractors in the country for the precision heat treatment of magnesium and aluminum.

YOUR PRODUCTION SCHEDULE INSURED

Isolation of the work chamber from any damaging radiant heat source plus the accurate temperature control of the voluminous stream of heated air makes the Cyclone the perfect furnace to meet the close heat tolerances demanded by magnesium and aluminum alloys. As a natural result, production is speeded through more rapid and uniform heating and costly spoilage of vital materials is eliminated due to the accurate heating control.

The 78 different vertical type sizes and 62 sizes of the box type, allow you a wide range of selection in planning your production schedule. For more detailed information on either the box or vertical type, both gas fired and electrically heated, the appropriate bulletins will be sent on request.

LINDBERG ENGINEERING COMPANY
2445 WEST HUBBARD STREET • CHICAGO

LINDBERG FURNACES

SUPER-CYCLONE FOR HARDENING, NORMALIZING, ANNEALING, TEMPERING
CYCLONE FOR ACCURATE, LOW COST TEMPERING OR NITRIDING
HYDRYZING FOR SCALE FREE AND DECARB FREE HARDENING

O W I Photo by Palmer in an Allegheny Ludlum plant

Steel Man with a Mission

. . TO KEEP THE ELECTRIC FURNACES MELTING

ALL of us—men or women—on the job or off it—are people with a mission these days. This war makes common cause for every one and spares no one.

The maintenance-man's job, atop an Allegheny Ludlum electric furnace, is no less essential than that of the crew who operate the furnace, nor than that of the fabricators who use the stainless, tool, valve or electrical steel it produces. Total war demands maximum cooperation on the supply fronts as well as the fighting fronts, and it asks also that every last bit of manpower and materials be used to maximum advantage.

Boiled down to a very few words, that simply means: *no waste—everybody help.* How can we help *you* to produce better and faster for war; to stop the loopholes of waste; and to plan your course in post-war production?

For your designers and technicians, complete and certified laboratory data on all Allegheny Ludlum alloy steels are available in "Blue Sheet" form. For your engineers and production men, our "Handbook of Special Steels" contains comprehensive and valuable information; and our "Elementary Discussions," covering Tool and Stainless Steels were developed particularly for training course and student use.

• Write for any printed material that will help you, or to request the services of our Technical Staff.

Address Dept. AM.

Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

A-8711 . . . W & D

NEW *Book of Facts* ON AIRCRAFT TUBING

WHAT do you want to know about aircraft tubing? Get this new bulletin of facts and you can find most of the answers. It includes a convenient digest of government specifications, and various other data on aircraft tubing which will be found helpful to both designers and builders of all types of aircraft.

Main Features:

Grades of steel—Open Hearth and electric furnaces with various alloying elements. Characteristics and applications of these steels.

Weights, areas and mechanical properties.

Tubular aircraft specialties — landing gear struts, tapered wing spars, tapered longerons, etc.

Tables of various types useful for showing relations between hardness and tensile strength, temperature conversion tables, decimal equivalents and metric conversion tables.

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Everyone concerned with airplane design and the purchase of materials will find this book a valuable aid. Send coupon for your copy.

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UNITED STATES STEEL

Free book on Tool Steel and its Treatment

Here's a new book that will be of practical value to anyone who works with tool steel. It's called *Tool Steel Treaters' Guide* and is a "how-to" manual from start to finish.

You'll find in it specific information on how to forge, normalize, anneal, spheroidize, cool and harden tool steel. You'll find many clear, informative photographs on quenching, P-F fracture standards, hot-acid etching, and grain structure. Also, there are two full-color charts showing the actual heat and temper colors of steel, through the heating and tempering ranges.

One section of the book is devoted to definitions of some of the terms used in the steel industry—hundreds of items are defined, ranging from "Air-Hardening Steel" to "Yield Strength." These definitions should be particularly helpful to new men in war-production jobs involving the handling of steel.

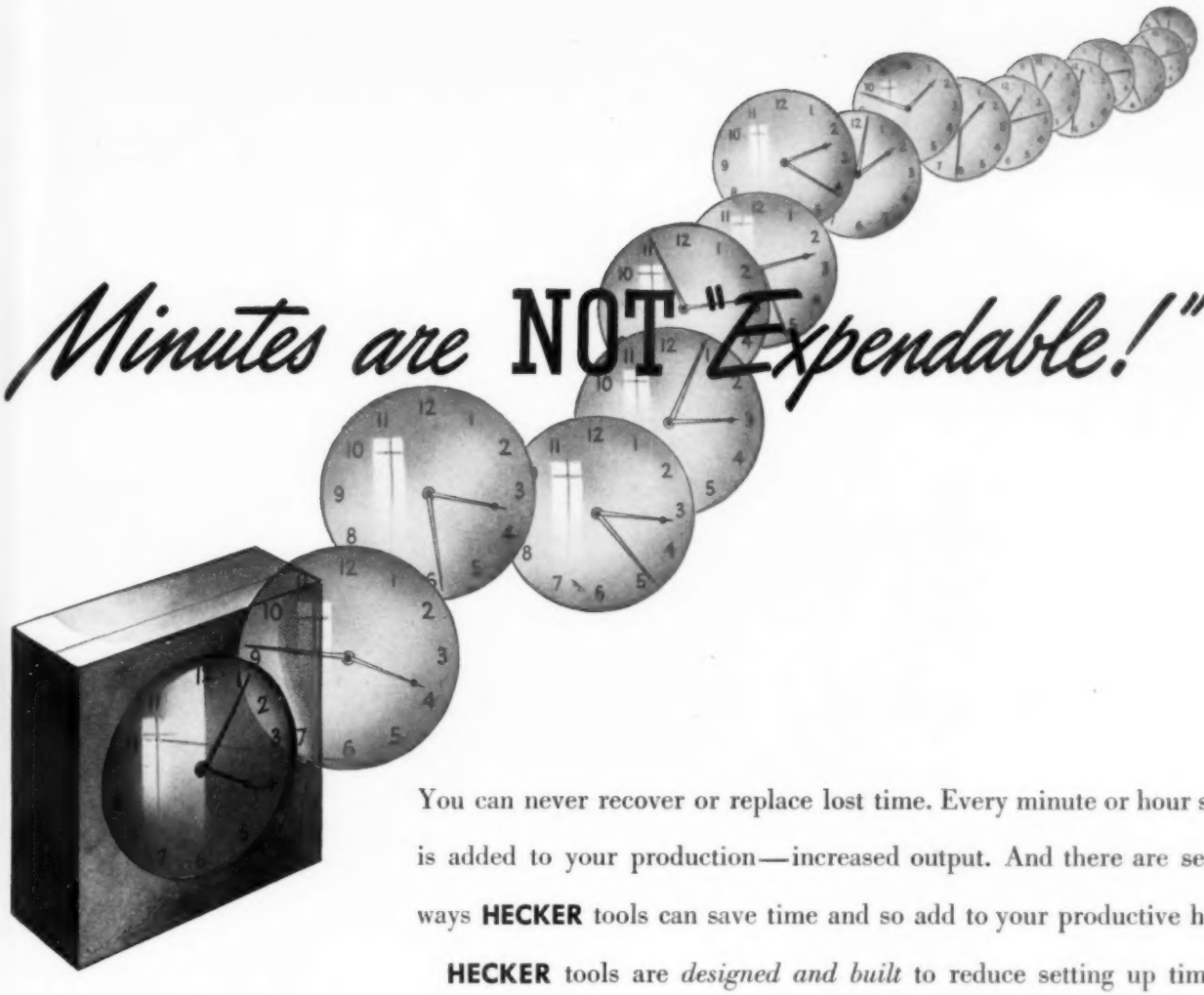
Another feature of the *Tool Steel Treaters' Guide* is its section of useful tables: weights and areas of square and round bars; weight per linear foot of flat bar steel; areas and weights of different shapes of steel bars; Brinell hardness numerals; hardness-conversion tables; temperature-conversion tables; revolutions per minute for assigned surface speeds; English-metric system equivalents.

Anyone who works with tool steel will find the 116 pages of the Tool Steel Treaters' Guide *packed with usable information. The guide will gladly be furnished free of charge to anyone who is engaged in war production. Write to Bethlehem Steel Company, Bethlehem, Pa., for a copy today.*

A Few of the Subjects Covered: NORMALIZING • ANNEALING • TEMPERING • QUENCHING MEDIA • MICROPHOTOGRAPHS OF HIGH-SPEED STEELS • HEAT AND TEMPER COLOR CHARTS • DEFINITIONS OF STEEL INDUSTRY TERMS • WEIGHTS OF STEEL BARS • FARENHEIT-CENTIGRADE • CONVERSION TABLES • DECIMAL EQUIVALENTS OF AN INCH FOR EACH 64TH.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY



Minutes are NOT *"Expendable!"*

You can never recover or replace lost time. Every minute or hour saved is added to your production—increased output. And there are several ways **HECKER** tools can save time and so add to your productive hours.

HECKER tools are *designed and built* to reduce setting up time, to facilitate precision work, to help inexperienced workers reach and maintain normal output and to cut the number of rejects.

Much of the extra know-how that our engineers put into every **HECKER** tool comes from constant contact with our own production work on precision parts for aircraft. This first-hand knowledge of men, machines and varied job requirements is the *plus* in **HECKER** tooling service.

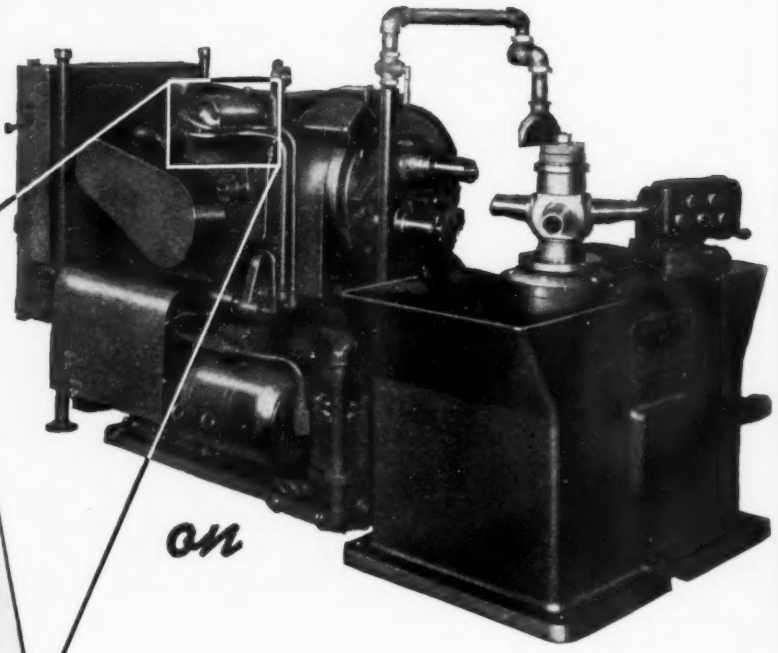
Let us work out your toughest tooling problem as a demonstration of **HECKER** service. Write A. W. Hecker, 1982 East 66th Street, Cleveland, Ohio, or 517 New Center Building, Detroit, Michigan.

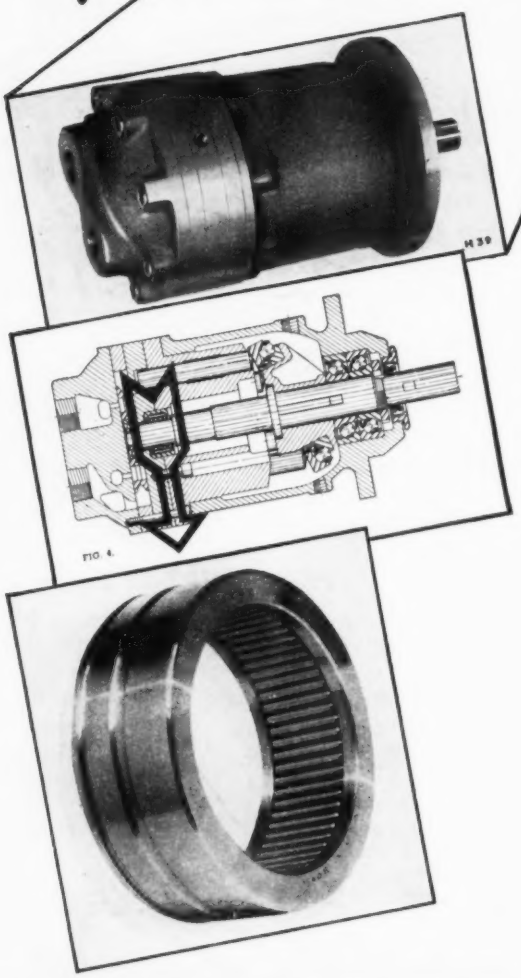
A★W★ Hecker

DESIGNERS AND BUILDERS OF TOOLS, JIGS AND FIXTURES—FABRICATORS OF AIRCRAFT PARTS

RBC NEEDLE BEARINGS

help speed war production on





SUNDSTRAND Hydraulic Units

Milling the curved surfaces of airplane propeller hub spiders is speeded up by the use of a Sundstrand Fluid Motor which rotates the head on the milling machine shown above. Sundstrand says in part, "All of the parts (of the motor) are designed for precision manufacture to exceedingly close limits. Friction between moving parts is negligible. . ."

Here then is a logical application for RBC CYCLOPS Bearings, anti-friction type carrying heavy radial loads and occupying minimum space. It is a self-contained bearing with a one piece through hardened and ground outer race encasing a full complement of rollers. An oil groove in the race eliminates the necessity of grooving the housing while a snap ring channel makes it easy to locate and secure the bearing in the housing.

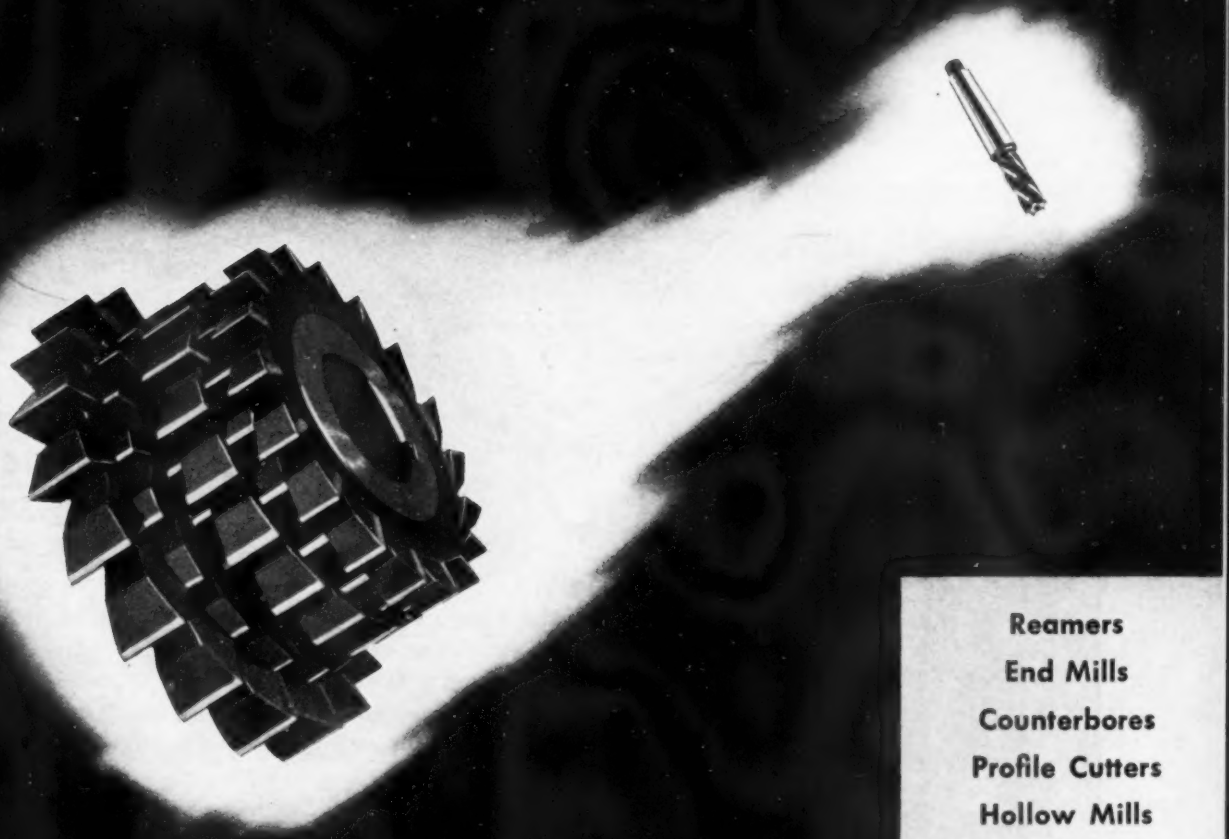
On any problem affecting the application of roller bearings to any type of machinery or industrial equipment, call on RBC engineers.

ROLLER BEARING CO. of AMERICA

TRENTON . . . . NEW JERSEY

"SPECIALS" On Time

SPECIAL PRECISION CUTTERS OF HIGH-SPEED STEEL
for
AIRCRAFT — GUN — WAR INDUSTRIES



To meet the demands of the war program — ON TIME — C & W is constantly expanding plant capacity. C & W is one of the largest producers of special high-speed precision cutting tools — and has an outstanding record in meeting promised delivery schedules.

Write for illustrated pamphlet — Consult us on your tool requirements

Reamers
End Mills
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Tapered Reamers
Gun Drills
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C & W TOOL COMPANY

19 Chestnut Street, Cambridge, Massachusetts

NEW YORK PHILADELPHIA DETROIT

C&W TOOLS

FOR OVER 30 YEARS—QUALITY PRECISION CUTTING TOOLS

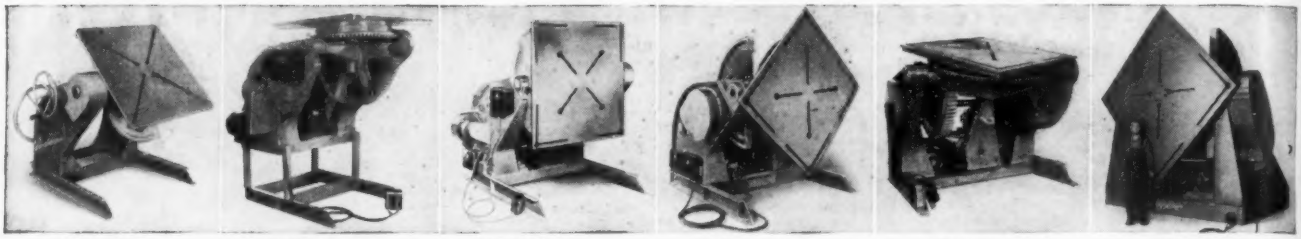
We'll hold it while you weld it...

If you're doing a welding job on war production, you can get Ransome Positioners to help you increase your output and reduce costs.

With this modern equipment, your welders can readily swing the heaviest and most complicated pieces for a downhand position on every pass . . . top, sides, and bottom, with one set-up.

Made in a complete range of types and sizes . . . hand-operated and motor-operated . . . up to 20-ton capacity . . . there's a unit that will fit your needs exactly.

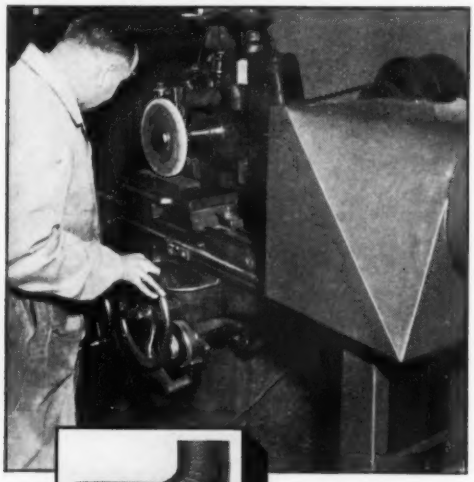
● ***Write for literature showing how Ransome Positioners can solve some of your major welding problems.***

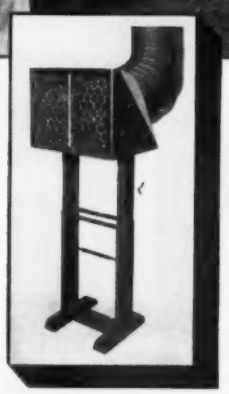


Light-duty, hand-operated | 2500-lb. cap., elevating base | 3000-lb. cap. | 3-ton cap. | 8-ton cap. | 20-ton cap.

Ransome WELDING POSITIONERS

INDUSTRIAL DIVISION • RANSOME MACHINERY COMPANY • DUNELLEN, NEW JERSEY





The coupon will bring you this new Filtaire Folder.

Filtaire

PORTABLE DUST COLLECTOR ELIMINATES THE DANGER, EXPENSE AND NUISANCE OF DUST AND DIRT

The Filtaire Portable Dust Collector will soon pay for itself in your shop by eliminating the damage caused by the dust and dirt from grinding and polishing operations. It is particularly useful where no central dust collecting system is available. It is completely self-contained, yet fits any machine—without the use of special hoods, tank or piping.

The Filtaire is equipped with a spun glass Dustop filter which is easily replaceable, inexpensive and completely fireproof.

An added feature, particularly important today, is the fact that the Filtaire recirculates warm air—it does not expel it from the shop!

COUPON

Please send me complete information on the Filtaire Portable Dust Collector.

NAME ..... TITLE .....

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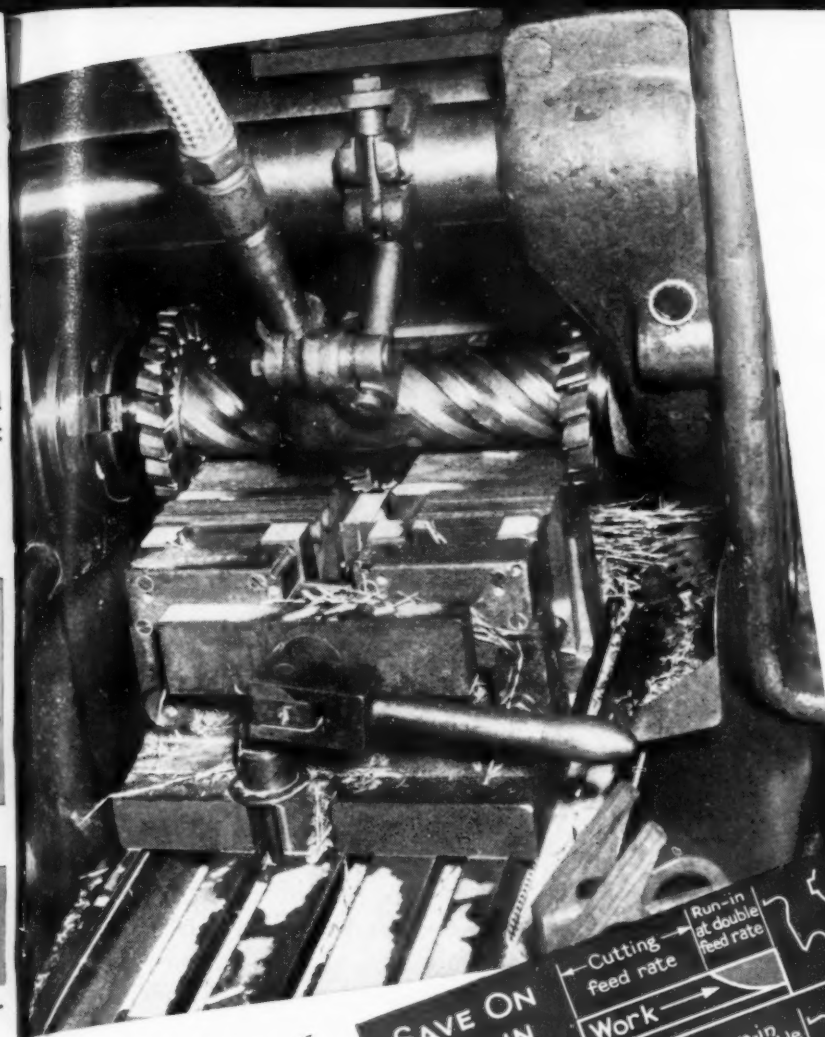
A.M.

EDWARD BLAKE COMPANY

634 COMMONWEALTH AVE., NEWTON CENTRE, MASS.

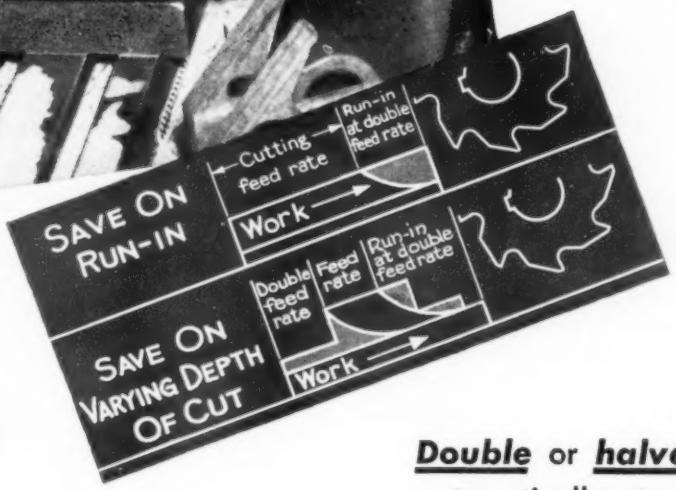
BLAKE TAP GRINDERS — FILTAIRE PORTABLE DUST COLLECTORS — AMERICAN TOOL HOLDERS — BLACK DIAMOND PRECISION DRILL GRINDERS — L & D HIGH SPEED DRILL PRESSES



Greater Production from your No 12s!

—USE THE DUAL FEED RATE

Save time on run-in —and on work where amount of stock removed varies during cut



We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U.S.A.

Deliveries Are Good on New No 12's

Double or ***halve*** the selected cutting feed automatically at any desired point in the cut, as follows:

Double any of the 16 feed rates available from ½ to 17½ inches per minute.

Halve any of the 16 rates from 1 to 35 inches per minute.

KEEP MACHINES PRODUCING

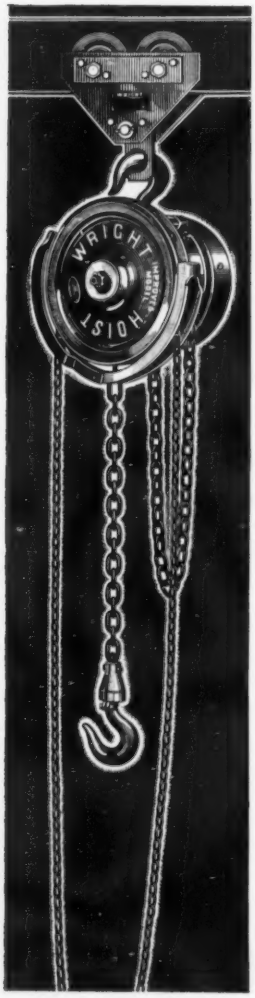
- Keep them clean
- Lubricate regularly with proper oils
- Keep bearings and gibs adjusted

—A little consideration on your part will prevent unnecessary wear, breakdowns and repairs

These savings frequently **cut production time in half**—sometimes more—on your No. 12 Plain Milling Machines.

BROWN & SHARPE

INSPECT REGULARLY!



Don't neglect your **WRIGHT HOISTS.** Make them last longer by regular and proper maintenance. Here are a few suggestions:

Put the grease gun to work! A **WRIGHT HOIST** needs thorough lubrication once a month. Keep the load chain well lubricated, too.

Don't overload your hoist. While **WRIGHTS** are famous for their ability to stand abuse, this is no time to abuse machinery. Overloading results in a stretched chain which cannot seat itself properly in sheave pockets, thus accelerating wear.

Watch the load hook. WRIGHT hooks, drop-forged from special steel, give visible warning of overloading by slowly opening. Don't continue to use hooks that have stretched.

Inspect your hoists regularly. Remember: where properly maintained, **WRIGHT HOISTS** have given continuous, trouble-free service for 20 to 25 years.

In Business for Your Safety

WRIGHT MANUFACTURING DIVISION

York, Pa., Chicago, San Francisco
New York

AMERICAN CHAIN & CABLE COMPANY, INC.

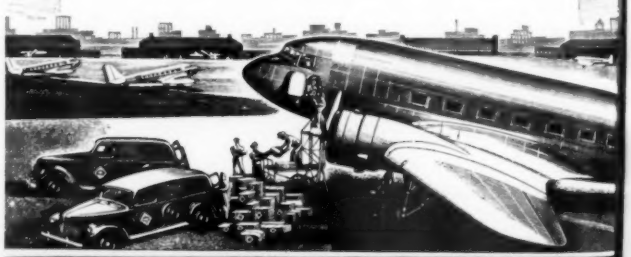
BRIDGEPORT, CONNECTICUT

AIR EXPRESS TONNAGE GAINS 93.6%

"The impetus given by the war to AIR EXPRESS operations . . . is indicated in figures for the first ten months of 1942 showing a rise of 93.6 per cent in pounds carried . . . Despite release of about half of commercial air-line equipment to the Army early in the year, nevertheless, by rearrangement of schedules, increasing plane hours a day, and stepping up plane maintenance and servicing, air lines are equaling and even surpassing pre-war performance."

Excerpt from *New York Herald Tribune*, January 11, 1943

Although you do not need a priority to ship by AIR EXPRESS, if you have war production shipments requiring priorities, they will be granted. Phone Railway Express Agency, AIR EXPRESS DIVISION, or any air line.

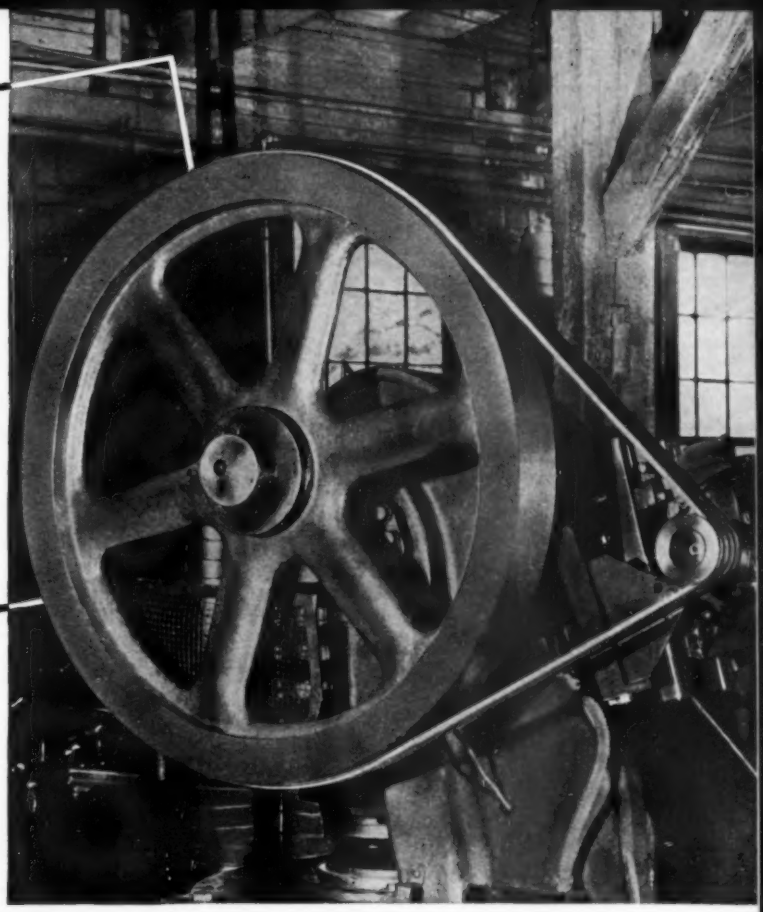


NOW IN ITS 16th YEAR

AIR EXPRESS

Division of RAILWAY EXPRESS

"9 Hours Output in Each 8-Hour Shift"

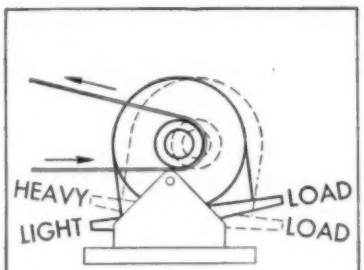


• • • reports one manufacturer who adopted American Econ-o-matic Short Center Drives for his punch presses. The gain in output resulted from reduced belt slippage—thus sustaining the RPM speed at correct level—and eliminating frequent "time-outs" for adjusting belt tension.

Improper belt tension creates many troublesome problems. When belts are too loose, you are losing RPM's and cutting down the productive output of your machines. When tension is too tight, belts and bearings burn up, forcing shutdowns and interrupting production.

By changing over to an American Econ-o-matic Drive, you can overcome these problems—boost your machine output—and greatly increase belt and bearing life. The Econ-o-matic Drive is an American Short Center Drive, either Flat belt or V-belt, with an Econ-o-matic motor base that gives you *automatic* belt tension control. No more worry about belts too tight or too loose—no lost RPM's—no slippage—no unnecessary "time-outs" to make frequent manual adjustments, after you install American Econ-o-matic Drives.

AMERICAN Econ-o-matic DRIVE



NOTE AUTOMATIC CONTROL OF BELT TENSION

The *load* governs the belt tension. Here is the heart of the Econ-o-matic Drive . . . the American Econ-o-matic Motor Base. It *automatically* and *instantly* matches belt tension to each variation in the pull of the load. When the load is *heavy*, motor base *pulls* and *tightens* the belt. When the load is *light*, motor base *slackens* and *loosens* the belt. No slide rails or idlers to adjust. It's *automatic!*

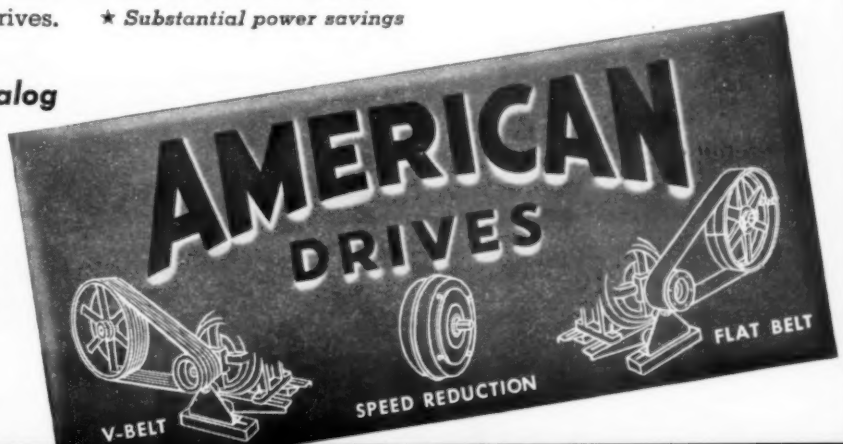
Check these advantages of the AMERICAN Econ-o-matic DRIVE (Short-center Flat — or V-Belt Type)

- ★ *Longer life for belts and bearings*
- ★ *No belt slip—no lost RPM's*
- ★ *Maintenance man-hours greatly reduced*
- ★ *Smooth, cushioned starting*
- ★ *Increased machine output*
- ★ *Substantial power savings*

Navy "E" for excellence awarded February 12, 1942

Get This New Econ-o-matic Catalog

36 pages of helpful information that shows you how to solve drive maintenance problems—how to increase belt and bearing life—how this drive can help you increase machine output. This catalog provides you with complete information on American Econ-o-matic Drives, and shows how to select the right drive for your purpose. Send for your copy. Write now.



The American Pulley Company

PHILADELPHIA, PENNSYLVANIA

. . But his customer got the Gauges in time!

Recently a Purchasing Agent handed a Distributor's salesman an order for a set of Gauges—normally a stock item with any well-equipped Jobber.

But the local factories are loaded up with precision work—first it seemed Gauges would be hard to find, finally the salesman admitted none were to be had.

"We haven't quit trying," he reminded the P. A.—from his own office he called a responsible manufacturer 600 miles away. "Yes," replied the Gauge man, "we have some of those sizes and will ship today."

This incident is typical of the unusual services that many Mill Supply Distributors are rendering their customers during the Emergency.

When the Distributor billed the job, he added $6.00 normal gross profit. Then he paid the Telephone Company a $4.00 toll, leaving $2.00 for himself. Still he feels he is away ahead because one of his standard policies is to say "thanks—sure we'll take care of you on every order."

You like to do business with firms like that and so do we. Years ago we began appointing them *our* Distributors—and *your* close-at-hand source of supply for Cle-Forge High-Speed Drills and Peerless High-Speed Reamers throughout Industrial America.

ARMY NAVY

Awarded May 22, 1942
Superseded July 13, 1942

The CLEVELAND TWIST DRILL COMPANY
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CLEVELAND

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

30 READE ST. NEW YORK · 9 NORTH JEFFERSON ST. CHICAGO · 650 HOWARD ST. SAN FRANCISCO
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ARMY E NAVY

Awarded August 8, 1942
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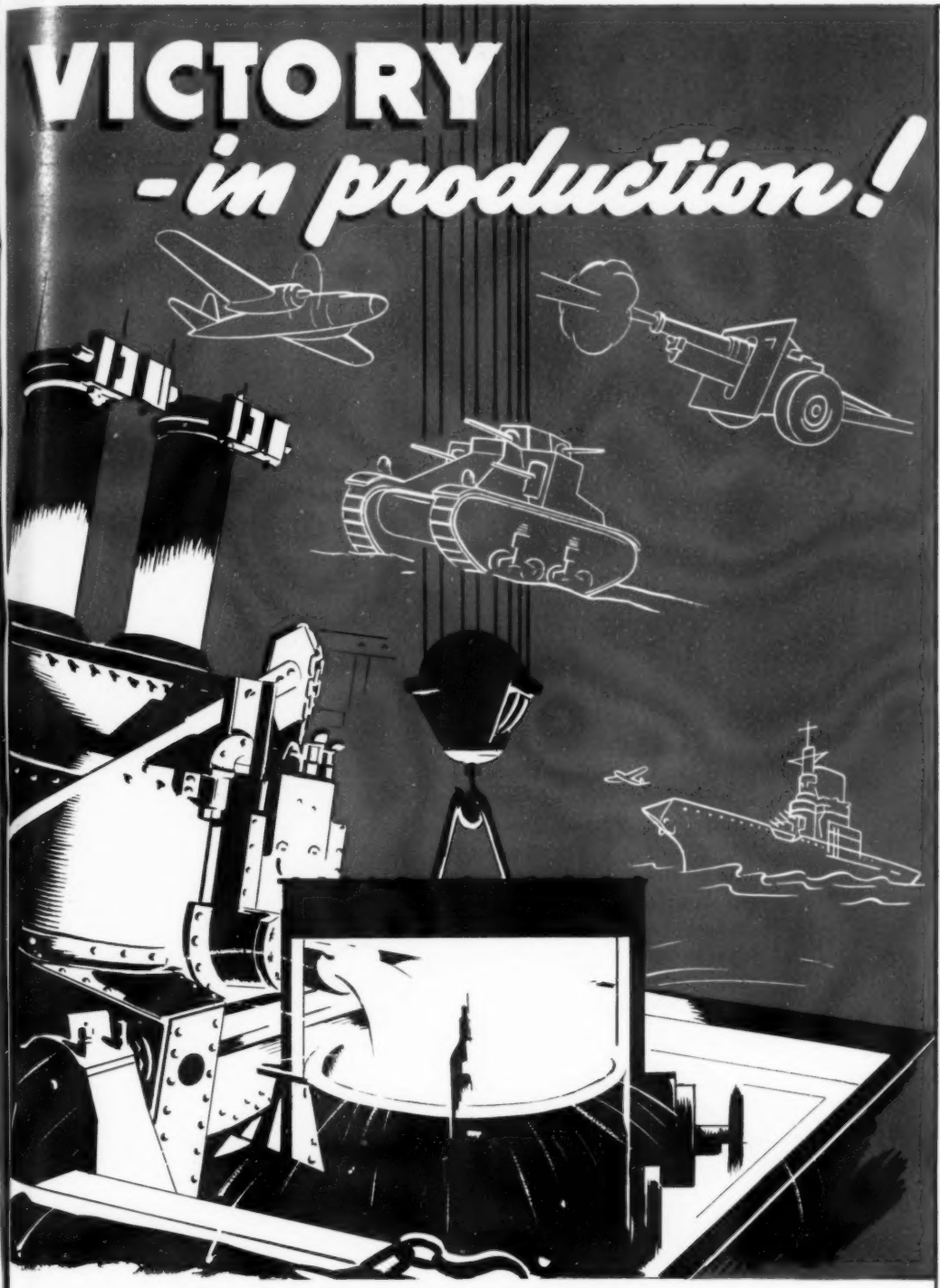
"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU



By the thousands they're being turned out . . . death-dealing war materials "consigned" to the Axis . . . to be delivered by air—land—water—and from the spitting ends of guns and cannon! Here at Braeburn we're proud of the part we're playing in this race toward Victory. Proud to know that an ever-increasing share of the vital tool steel used in the manufacture of war materials is OUR tool steel. Proud that we're working 'round the clock to produce steel essential to the manufacture of planes—tanks—ships—shells—and bullets. The entire Braeburn Steel organization is out to help win this war through never-ceasing, wholehearted cooperation with the Army, Navy, and all those myriad plants throughout the country producing shells, tanks, ships, and planes. Without our product, vital tools for the manufacture of war machines could not be produced. *AT THIS VERY MOMENT, ON EVERY BATTLEFRONT, BRAEBURN IS IN THE FIGHT!*

Braeburn Alloy Steel Corporation

BRAEBURN, PENNSYLVANIA

100% OF CAPACITY ON WAR PRODUCTION

V

To Paraphrase
Alice
In
Wonderland—

"The time has come
Don Nelson said
To Make So Many
Things
Like Ships and
Tanks and
Aeroplanes
And Guns with
Lethal stings"

V

Braeburn Products Run the Complete Gamut of Application of Tool Steels in the Production of War Materials. A List of War Materials Produced With Braeburn Tool Steels Would Include Every Type Used Today in the Manufacture of Shells, Cartridge Cases, Tanks, Guns, and Planes. Our Product is the Vital Material From Which the Perishable Tool Industry Makes Its Much Needed Tools for War Production.

V

PRODUCTION
1940 — 100%
1942 — 476%

TUNGSTEN • MOLYBDENUM • HIGH SPEED STEEL

MANY *times Longer Life* than Hard Steel Gage Blocks

You can now reduce the cost of maintaining your sets of gage blocks by specifying the use of Dearborn Chromium Plated Standards. Their longer wearing qualities makes them ideal for use on production checking operations. Let us prove to you how industry is reducing gage costs through the use of Dearborn Standards.

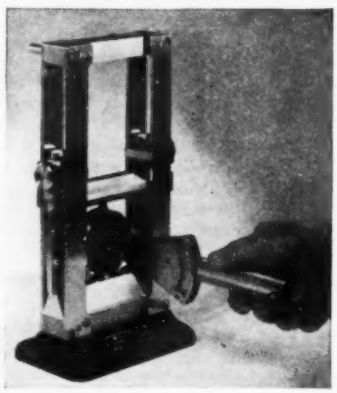
DEARBORN GAGE COMPANY

Originators of Chromium Plated Gage Blocks

22035 BEECH STREET • • • DEARBORN, MICH.

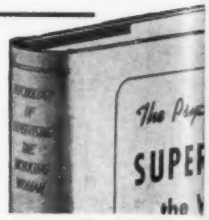
SET YOUR INTERNAL INDICATORS WITH GREATER EFFICIENCY

● This Ellstrom Internal Setting Gage eliminates the old-fashioned, time-wasting method of using clamps and parallels with gage blocks to check internal indicators. For example: if the Ellstrom Gage is adjusted for a 2" reading and a 1.875" reading is desired it isn't necessary to make a readjustment; all that is required is to wring a .125 gage block on the bottom surface of the gage immediately giving you this reading.



Your increasing problems of managing women–

solved by the key points given in this new book



Just Published

The Psychology of SUPERVISING THE WORKING WOMAN

By **DONALD LAIRD,** Industrial Consultant With the assistance of Eleanor C. Laird. Research Librarian. 202 pages, 5½ x 8, illustrated. **$2.00**

As the war has its effect on manpower, greatly increasing the number of women in your working force, what are you doing to meet the new problems involved? Here is a practical manual to help you. It gives the practical essence of what glandular, medical and mental specialists as well as industrial experience shows to be critical in supervising women, and shows how these many facts may be applied in adjusting work to woman's physical characteristics, dealing with her in relations with her superiors and associates, and generally promoting her contentment and efficiency on the job.

How do women compare with men in general intelligence or "brain power?"

For what mechanical manipulations is woman best fitted?

Should the average woman be allowed much initiative on the job?

What are simple adjustments to compensate for woman's lesser strength?

How do women react to overtime and heavy work schedules?

How should work places be planned to facilitate best work by women?

How should women dress on the job?

What type of supervisor is best for women?

On what basis will women best team up with other workers?

What effect do woman's personal problems have on her work?

What is the basis of handling crushes and jealousies between women workers?

Book answers these and kindred questions in a way that every foreman, personnel man, and executive can understand and apply in specific cases in his own business. Applicable not only in factories but in all offices and businesses employing women.

READ IT 10 DAYS FREE

McGraw-Hill Book Co., 330 W. 42 St., N.Y.C.

Send me Laird's Psychology of Supervising the Working Woman for 10 days' examination on approval. In 10 days I will send $2.00 plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

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Company ..... A. 2-11-43

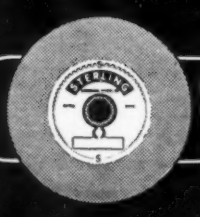
THIS MAN'S JOB WILL BE FELT AROUND THE WORLD

IN Africa, Australia, Iceland, Alaska, Hawaii, New Guinea and on other teeming war fronts, American equipment is doing a better job and lasting longer under stress than the guns, tanks, ships and planes of the Axis. The superiority of our Army, Navy and Marine equipment can be traced, in many cases, to the results of the welder's skill.

Welding research has accomplished miracles in the reduction of excess weight, elimination of structural weaknesses, creation of better design, and utilization of new materials. Today, because of the welder's art, we have greater power in smaller units, more efficient transportation of pressure to distant locations, greater safety, higher speeds, more economy! The application of these results of the welder's skill to wartime industry has certainly saved a year in our production effort, and accellerated the victory drive of our armed forces.

Sterling salutes the thousands of welder's - stalwart men and energetic women - who are today building, through their labor, the basis for permanent, lasting peace.

Sterling Weld Grinding and Finishing Wheels occupy a prominent place in speeding up the production of welded materials. These "Wheels of Industry" do a better faster job because they are planned to solve your particular weld-grinding and finishing problem. Ask for the service of a Sterling engineer today!



• STERLING ABRASIVES •

THE

STERLING GRINDING WHEEL DIVISION

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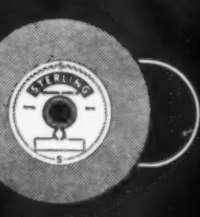

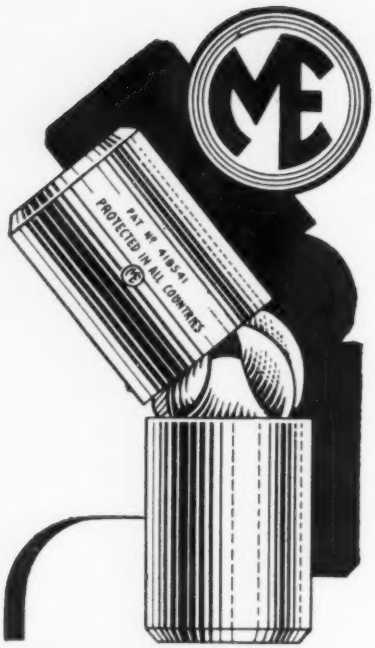

Patent

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Production Doubled

...ON SHRINK FIT ASSEMBLY OF AIRPLANE LANDING STRUTS!

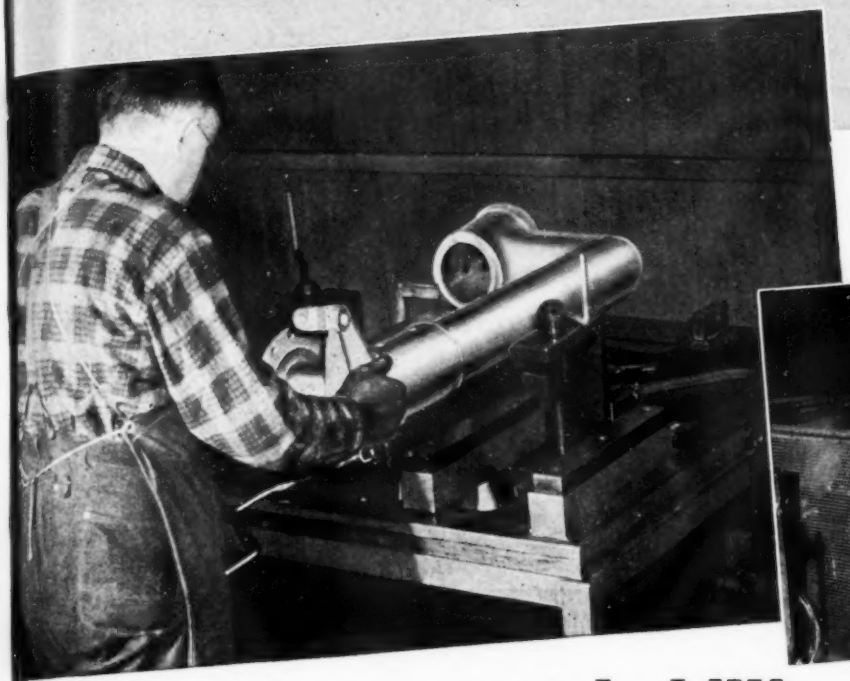
COMPANY NAMES STARTING WITH C*

increased production

Case Study from the Files of Deepfreeze

The Sub-Zero Method of Shrinking, Testing and Treating of Metals

*Name on request to bona-fide inquiries



Data and Part Information

Shrink-fit assembly of aircraft landing struts.

Diameter of bore—4.843" ± .002".

Diameter of mating part—4.843".

Deepfreeze metal chilling assures permanent assembly —reduces cost

These airplane landing struts, requiring a permanent shrink-fit, were formerly assembled in 20 minutes including heating time. This was done by heating the female part only.

With the installation of a Deepfreeze Cascade Industrial Unit, in conjunction with heating, the time has been reduced to 10 minutes—rejects minimized.

HOW IT'S DONE

The female part is heated in an oil bath at 450° F. and expanded .005". The male part is shrunk .003" in a Deepfreeze Cascade −120° F. Chilling Unit. The time in oil bath is 5 minutes—time in Deepfreeze 5 minutes. The cooling time to room temperature, in a jig, is 5 minutes—total 10 minutes. They are then inspected and wheel spindle must indicate within .003".

HOW DEEPFREEZE CAN HELP YOU... Deepfreeze sub-zero temperatures (as low as −120° F.) can help you in any one or all three of the following metal working operations:

1—Shrinking of metals for ease of bearing assembly, etc.

2—Testing of metals for reaction of sub-zero temperatures to aircraft instruments, etc.

3—Treating of metals for preventing growth or warp in gauges, etc.

FREE Additional Data *and proof of the outstanding success of the Deepfreeze method for chilling metals are included in this booklet. Write for your copy today.*

REQUIREMENTS

To obtain a *permanent* shrink-fit assembly of airplane landing struts.

DIFFICULTIES

Former method by heat only, unsatisfactory—could not hold even temperature. Too many rejects requiring pulling apart or disassembly.

Other Difficulties . . .

Dry ice was too costly, took too much time to crack and prepare...would not handle present production requirements.

SOLUTION

The Deepfreeze Cascade −120° F. Unit used in combination with an oil bath for mating part, meets every requirement, doubles production.

SAVINGS

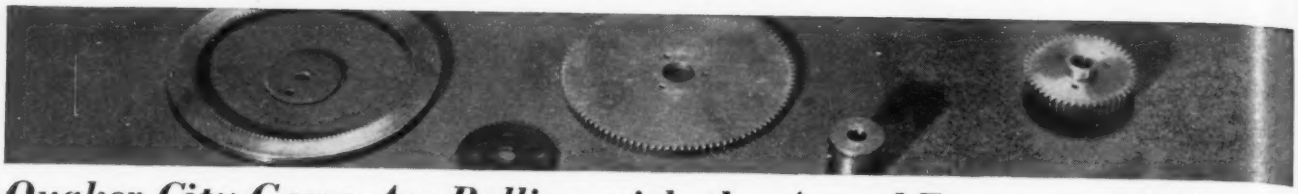
In addition to savings in time, new method saves approximately $30.00 per day—cost of dry ice.

Deepfreeze

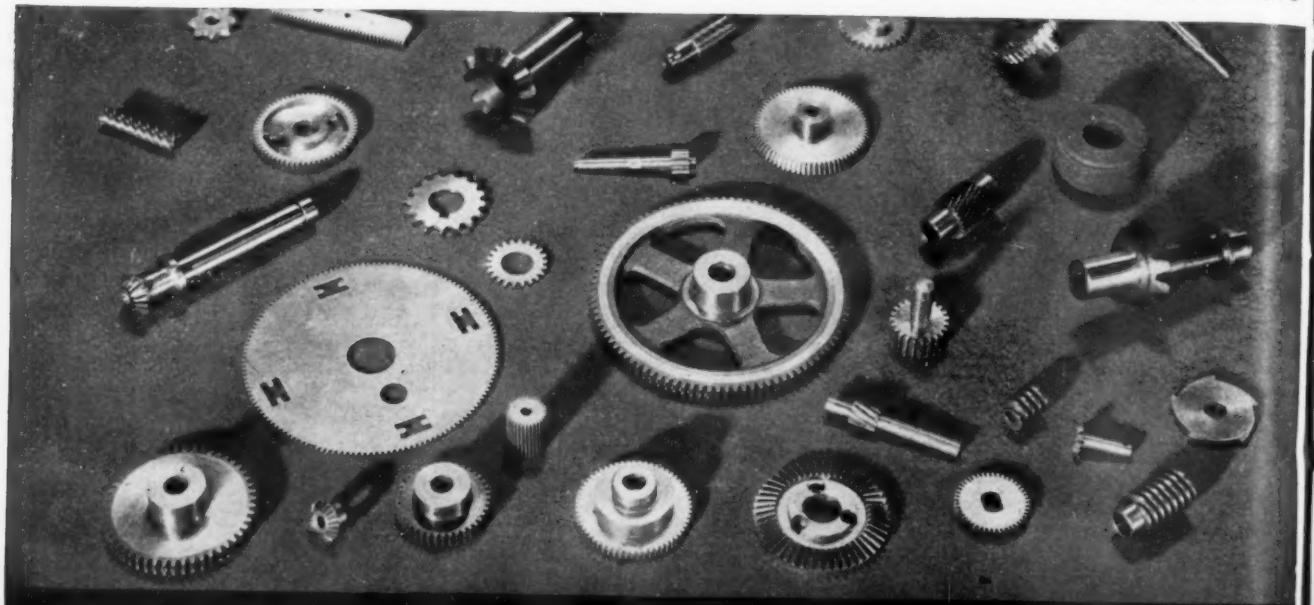
DIVISION

MOTOR PRODUCTS CORPORATION

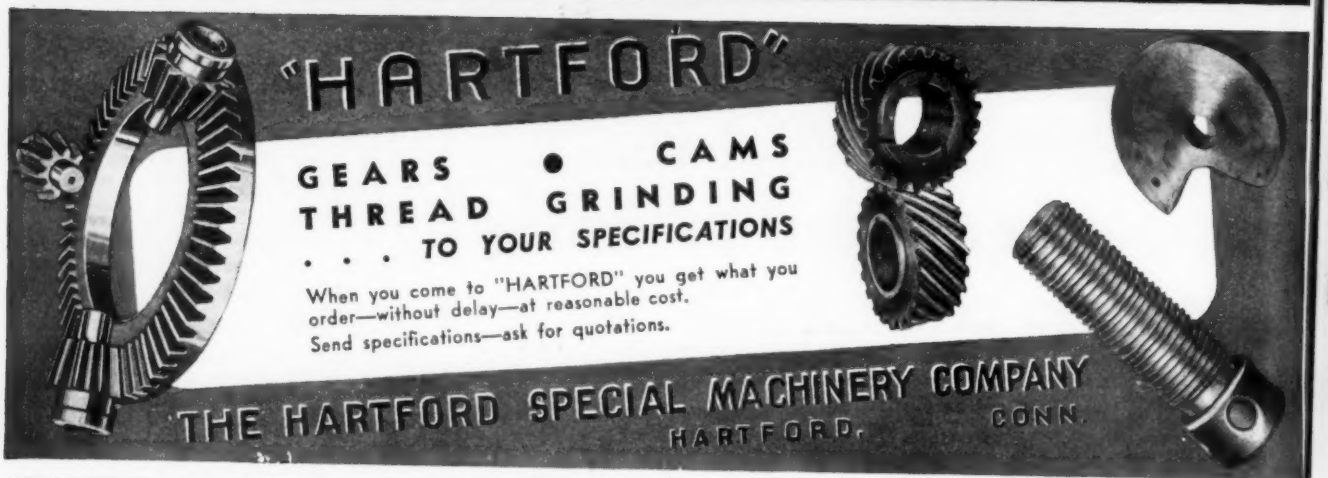
2327 DAVIS ST., NORTH CHICAGO, ILLINOIS



Quaker City Gears Are Rolling with the Armed Forces on All Fronts



QUAKER CITY GEAR WORKS 1910-32 N. FRONT ST. PHILADELPHIA, PA.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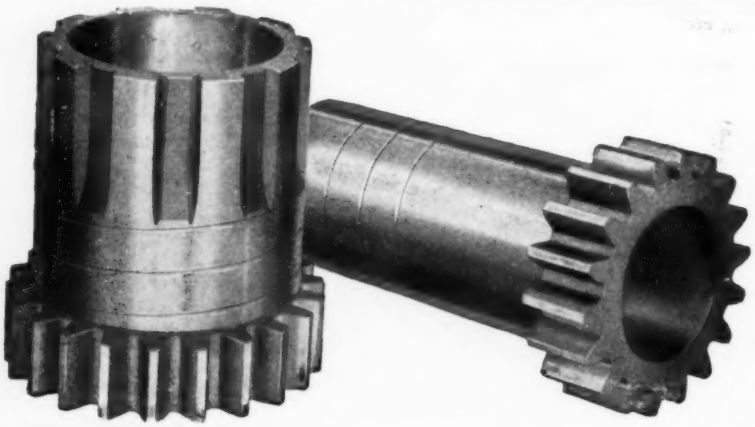

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This range logically embraces the gear components of many critical control devices essential to the war effort and this organization is proud of its contributions of such material in the program.

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MULTIPLE DISC DESIGN IS SIMPLY ADJUSTED and EASILY CONTROLLED

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The use of separator springs between the active discs in the JOHNSON "MAXITORQ" FLOATING PLATE CLUTCH assure quick disengaging and prevent excessive drag. Abrasion and heat common to many clutches of the multiple disc type are absent in the "MAXITORQ."

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This new development by Johnson is provided with a very simple manual adjustment so that smooth operation can be maintained under all power transmission requirements. Sensitive starting, safety and quietness are other advantageous operating features.

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Write for Multi-Disc clutch catalogue No. 21 or consult Sweet's or Thomas' Reg.

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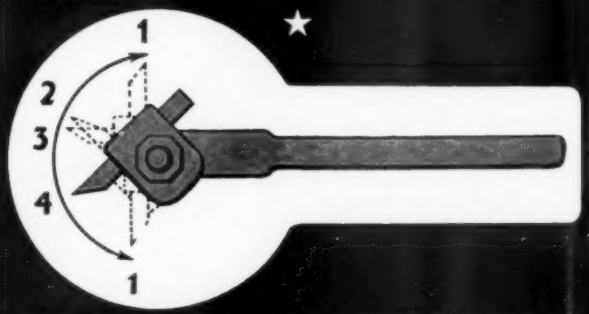

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One of the quickest . . . easiest ways to step-up production efficiency . . . gain time . . . cut costs . . . is to select "Cincinnati Gears" for your assemblies.

Each Cincinnati Gear "Measures Up" to every industrial requirement.

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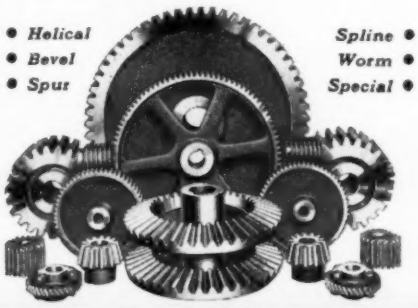

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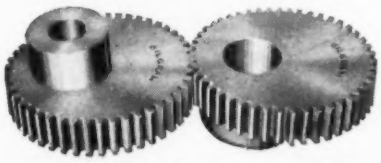

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Also Other Non-Circular Gears

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. . . the Third Degree!

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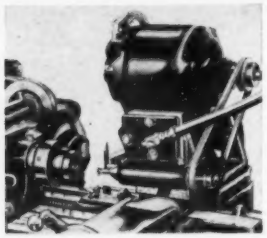
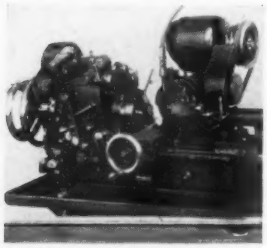
WALTHAM THREAD MILLERS

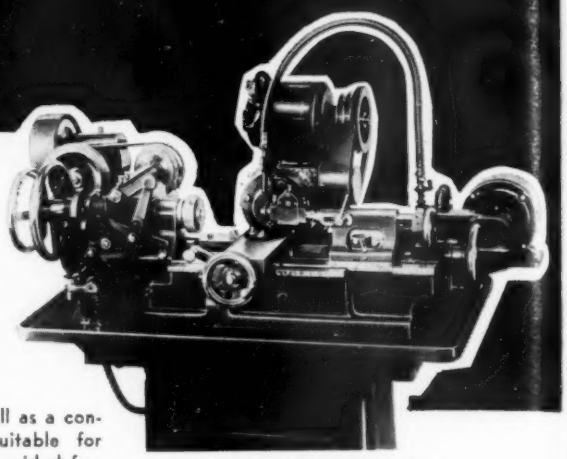
put precision thread milling on a production basis



Waltham Thread Miller equipped with Internal Threading Attachment.



Machine equipped with Relieving Attachment.



These improved machines are fast, accurate and versatile. They will mill all standard forms of threads quickly, conveniently and accurately, cutters for which are available from Waltham.

Standard design includes three motors (one each for speed, feed and oil), a feature which permits individual speed change and reverse for both cutter and the work as well as a constant speed for the pump. Speeds suitable for either brass or steel or both are easily provided for. All motors are controlled from one convenient station.

Extra equipment available includes: plain and compound taper attachments, translating gears for cutting metric leads, metric lead screw, relieving attachment, special heads for internal and multiple cutter threading, and automatic cam operation, special equipment for cutting long lead.

SPECIFICATIONS

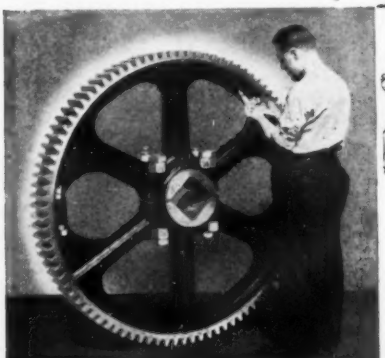
Swing over carriage 3"
Capacity (Diameter of work) 2" or smaller
Thread length (work held on centers) 8¾"
Thread length (work held in spring chuck at one end) 10"
Diam. hole through spring chuck ⅝"
Dia. hole through work spindle ¾"
Floor Space 48" x 34"
Motors: 1/3-1/4 and 1/6 HP

SEND FOR DESCRIPTIVE LITERATURE GIVING COMPLETE DETAILS.

WALTHAM MACHINE WORKS

WALTHAM MASS.

WALTHAM TRADE MARK REGISTERED U S PAT OFF



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However, Stahl gives the same careful attention to all specifications for gears, large or small. Our modern facilities enable us to produce many types of gears and of any material—AT PRICES WHICH WILL INTEREST YOU.

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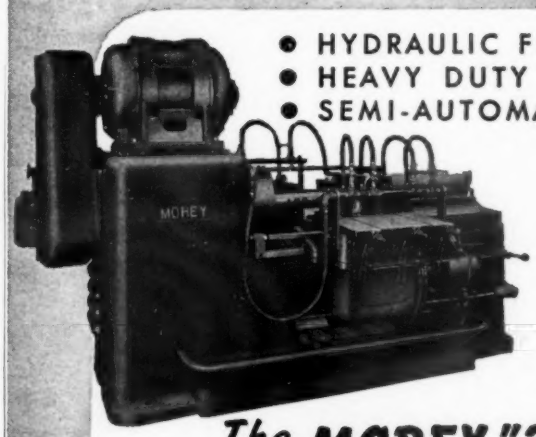
Suitable for 105 M.M. to 155 M.M. Shells

- HYDRAULIC FEED
- HEAVY DUTY
- SEMI-AUTOMATIC



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The HYDRAULIC FEED insures an almost effortless operation. Rigid enough to use carbide tools to their full capacity—entirely self-contained—no outside or auxiliary equipment required! Details in Circular 715—ask for it.

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MACHINERY MANUFACTURER or INVENTOR

to plan with us NOW for post-war expansion

War work has caused us to greatly increase our productive capacity. So when peace comes, we will have the equipment and trained personnel to manufacture not only our regular line of wrapping machines, but other types of machinery or devices. You may find it profitable to take part in our planning for such post-war expansion.

For 30 years we have been one of the leading makers of packaging machinery. Our machines are used by hundreds of concerns — in the food, drug, candy, tobacco, dairy fields, etc. Many of the advancements in mechanical wrapping now widely used were conceived by our Engineering and Designing Department.

For war, we have *designed and built* large groups of armament machines such as cartridge loaders, cartridge-clip loaders, machines to insert cartridges into cartons, linking machines for machine-gun bullets, etc.

We are now working on ideas to expand our regular line of wrapping machines and to add other lines of machines used by industries we do not now serve.

● You may have ideas for new machinery which need development. We will be glad to discuss them with you, and if mutually satisfactory, will develop them with you.

● You may have a machine or machines which you have been making in your own plant, but which might be improved and made with greater profit in ours.

Final arrangements may result in your coming into our Company — or may be worked out on some other desirable basis.

If you feel that you have something on which we might work together, we suggest that you communicate with us, giving full particulars. We can then arrange for a meeting.

PACKAGE MACHINERY COMPANY · Springfield, Mass.

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Many plants, otherwise top-notch in efficiency, are losing time and money in the rough-cut department. That's why more and more are switching to Kalamazoo Metal-Cutting Band Saws! These modern precision machines allow cuts within thousandths of an inch —save machining time and precious metal. New, stronger type drive carries full 5500 pound load—double that of similar saws. New hydraulic control gives instant holds in any position on frame. 8" x 16" and 8" x 24" capacities. Send for complete specifications.

Immediate Deliveries Now Available!

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36 HOLES in Propeller Blade Bushing *held to* ACCURACY *of* ±.0005″ *with* HIGH FINISH

(Above) All dimensions in finish boring the 36 high-finish holes in these Bronze Propeller Blade Bushings are held to ±.0005″.

STOKERUNIT SIMPLEX PRECISION BORING MACHINE

Precision Bores Each Hole in 16 Seconds

A widely known manufacturer of airplane propeller parts is regularly using a battery of Stokerunit Simplex Precision Boring Machines to insure superior finish and precision accuracy in critical boring operations.

In the production of these alloy bronze propeller blade bushings, for example, an extremely fine finish with close tolerances is required in finish boring the 36 holes in the flange. All dimensions—roundness of hole, dimensions between holes and distance from center of bushing—are uniformly held to ±.0005″.

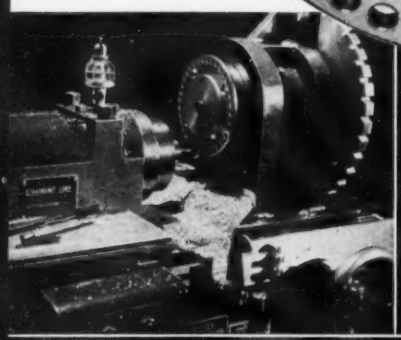
PRECISION ACCURACY AND FINE FINISH MAINTAINED IN PRODUCTION

In this setup, the Stokerunit Simplex Precision Boring Machine bores one hole at a time every 16 seconds in alloy bronze bushings—hardness 90-100 Rockwell. Hole is .3125″ in dia. ±.0005″ by ¼″ deep. Work slide is equipped with constant reciprocating feed, and indexing is done by hand when work is clear of tool. Feed is 4⅞″ per minute; spindle speed 1750 r.p.m. Every rigid requirement of accuracy and finish is consistently maintained.

VERSATILITY—Stokerunit Simplex Precision Boring Machines can be adapted to a multiplicity of precision boring operations—for either short-run or production work. They can be furnished with single or multiple spindles, depending upon your requirements. Over 25 models are available in both mechanical and hydraulic feeds and cover practically the entire range of precision boring applications.

Profit with precision accuracy, finer finish and increased production in your precision boring operations. Consult our engineers for a study of your parts and production problems.

For specific recommendations, send blueprints of parts with production requirements. No obligation.



(Left) One hole at a time is precision bored every 16 seconds.

(Right) The Simplex maintains precision accuracy and fine finish in production.

(Below) Partial view of battery of Stokerunit Simplex Precision Boring Machines in plant producing airplane propeller parts.

BULLETINS with Complete Data!

Write today for these two booklets covering our entire line of Simplex Precision Boring Machines. Full details and specifications of each type are included.

STOKERUNIT CORPORATION

DESIGNERS AND BUILDERS OF PRECISION BORING MACHINES AND MILLING MACH

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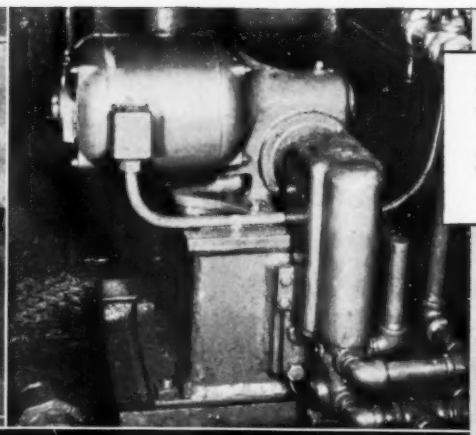
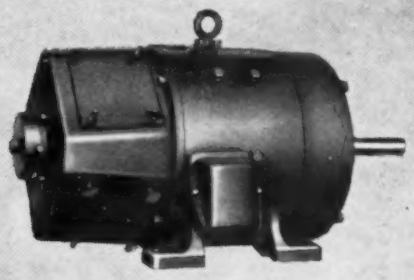


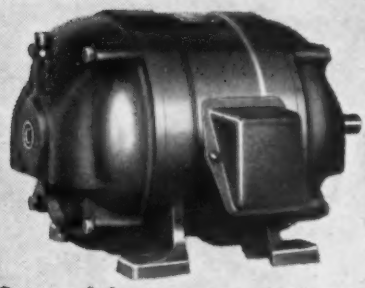
Extreme Left—Century 7½ horsepower, vertical mounted, direct current, drip proof water pump motor.
Left — Century ½ horsepower motor driving a Diesel oil pump.

CENTURY MOTORS and GENERATORS

For the Toughest Sea-Going Service Meet the Rigid War Requirements of Naval and Merchant Marine Applications



7½ horsepower, direct current, ball bearing, fabricated steel, water proof Navy motor.



Century 2 horsepower squirrel cage fabricated steel motor with cast steel end brackets.

Century shipboard motors and generators are built to stand up under

- The toughest sea-going service
- The shocks of gunfire and bombing
- The rigorous climatic conditions of the seven seas

They meet Navy Specifications 17M10 and 17M17, A.I.E.E., recommended practice on shipboard No. 45, and the Maritime Rules of Shipping.

Century Motors' famous ability to "keep a-running" is daily being demonstrated and thoroughly proven on the high seas in applications such as those mentioned above.

Your nearest Century Application and Service Engineer will gladly tell you all the advantages of Century Motors for *any* job.

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1806 Pine Street, St. Louis, Mo.
Offices and Stock Points in Principal Cities

Century MOTORS
Help You Beat the Production Promise

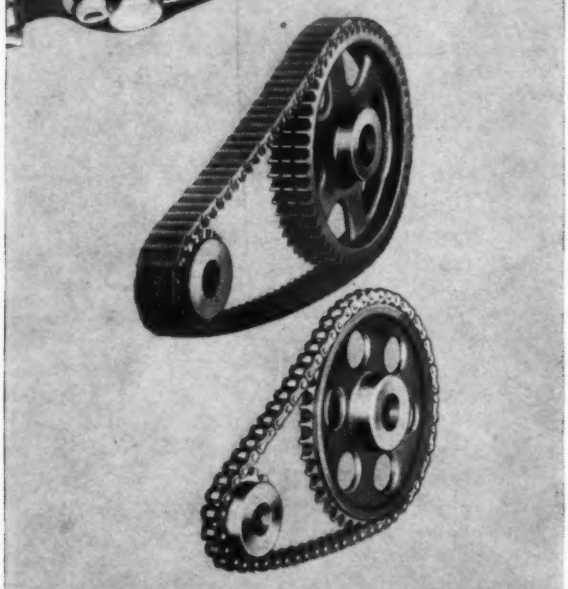
Among the many Naval and other marine applications of Century Motors that have been made and are being made today are the following:

Diesel fuel pump motors
Bilge pump motors
Transfer pump motors
Brine pump motors
Cooling water pumps
Fire pump motors
Capstain motors
Hoisting machinery motors
Pumps for fresh water stills
Air compressor motors
Refrigeration compressor motors
Steering gear motors
Fan and blower motors
Oil burner motors
Generators and motor generating sets for light, power, and communication
Workshop machinery motors

308

One of the Largest Exclusive Motor and Generator Manufacturers in the World.

MORE DRIVES *Using Chains*



When production requirements were a fraction of output capacity . . . when top machine efficiency was not vital . . . and lost down time could be handled by idle standby equipment and did not mean a possible loss of American fighting men's lives . . . then inefficient drives got by!

Now, planes and tanks, ships and guns are needed fast . . . parts production is vital . . . every K.W. of power . . . every R.P.M. . . . has an important job to do.

To meet today's production demands, more and more manufacturers are modernizing machine tool drives with Morse Chains, and specifying Morse Chain Drives on new machines. Many have found production increased as high as 25%, servicing time reduced, slipping and frictional contact losses eliminated and uniform production maintained.

Morse Engineers will help you modernize your drives for greater production.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

Protection...
AGAINST BOILER HEAT OR BLIZZARD COLD

Your motor starters may never have to cope with such extremes in temperature, but even *normal* variations will affect the operation of across-the-line starters unless they are equipped with *compensated* overload relays.

Only 5¾" x 5¼" x 4⅛"

These seemingly small overall dimensions are the result of precision engineering to give you a top-performance starter that can be installed in small spaces. Fully approved by Underwriters' Laboratory.

Five sizes are available . . . . 1.5 to 7.5 H.P. 110 to 550 V (A.C.)

The New Monitor THERMALOAD V SOLENOID STARTER

is a definite achievement in starter design and construction. Included in its many tried and proven features is the famous Monitor Compensated Thermal Overload Relay . . . . in order that extremes in ambient temperature will not affect its performance.

Thus, you get full overload protection for your motor under all kinds of installation characteristics . . . . the trip always occurs within the same time at a given percentage of overload.

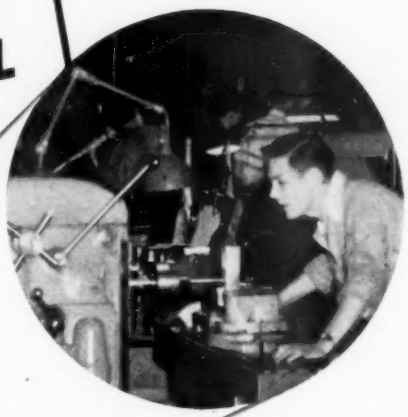
Look at this line-up of Thermaload V features: Vertical, Straight Line Design . . . . Resilient Shock-Proof Mounting for quiet operation . . . . Double Break Silver Contacts . . . . Easily-Interchangeable Coils for different voltages . . . . and the desirable Monitor Compensated Thermal Overload Relay. Never before have so many features been built into one starter. No wonder the Thermaload V is recommended for both original equipment and replacement.

Write your Monitor field engineer for further details and delivery dates.

The Monitor Controller Company

GAY, LOMBARD & FREDERICK STS. BALTIMORE, MARYLAND

"Balanced" Lighting
A MORE EFFICIENT TOOL
for Every Close-Seeing Task



LIGHTING FOR SEEING
Close-seeing tasks require from 100 to 300 footcandles and more of illumination for accuracy and safety. Only localized lighting can provide these intensities efficiently and economically.

Saves **CRITICAL MATERIAL**

Saves **POWER**

Saves **WORKERS' EYES**

Saves **TIME**

Saves **INVESTMENT**

Light for Seeing is the workman's most vital tool. As such, it is all-important that any lighting installation be based primarily on the seeing needs of individual work operations.

General surplus lighting of workrooms in order to provide better illumination of individual work areas is both impractical and uneconomical. But, with "balanced" lighting, illumination can be fitted and efficiently proportioned in the quality, quantity and distribution required for each close-seeing task. Localized Lighting provides the relatively high intensities necessary for adequate close-up illumination directly on the work area. Balanced with General Lighting to illuminate background and overall areas, every lighting need is served more efficiently and economically.

Give your plant, your workers, your Country the advantages of this better production tool. Write, today, for a Fostoria "balanced" lighting analysis and recommendation without obligation.

THE FOSTORIA PRESSED STEEL CORPORATION • Fostoria, Ohio
In Canada—write Amalgamated Electric Corp., Ltd., Toronto

For Study and Counsel on Your Lighting Problems

Fostoria Industrial Service Centers, located strategically in principal cities throughout the United States and Canada, are properly equipped and well qualified to solve your lighting problem. This service determines, first, what each worker's seeing requirements are on the job so he may work faster, accurately, safely, with a minimum loss of efficiency. It carries on to analyze specifically the kind, quantity and distribution of lighting which will properly provide the worker's seeing needs. It then selects and positions the lighting equipment to meet these specifications and stands ready at all times to maintain this equipment at top efficiency.

BALANCED LIGHTING
GENERALITE fostoria for Background Lighting
LOCALITE fostoria for Light ON the Job
for Better Seeing in Industry

PRECISION REGRINDING BY NEW TOOL CRAFTSMEN

Here at Severance Tool Company, worn tools and new tools are both ground by the same skilled craftsmen. The perfect cutting edges that insure clean, sharp bites with new Severance tools are put into worn tools by our regrinding service.

After being accurately reground, your renewed tools are further improved by the Severite Heat-treat hardening process which hardens the teeth of a cutter increasing the life from two to five times.

Severance regrinding saves you 80% of the cost of new tools and, in addition, helps keep your production line at top speed by offering 72 hour service. Your renewed tools are shipped within three days of the time they are received at any of the Severance plants.

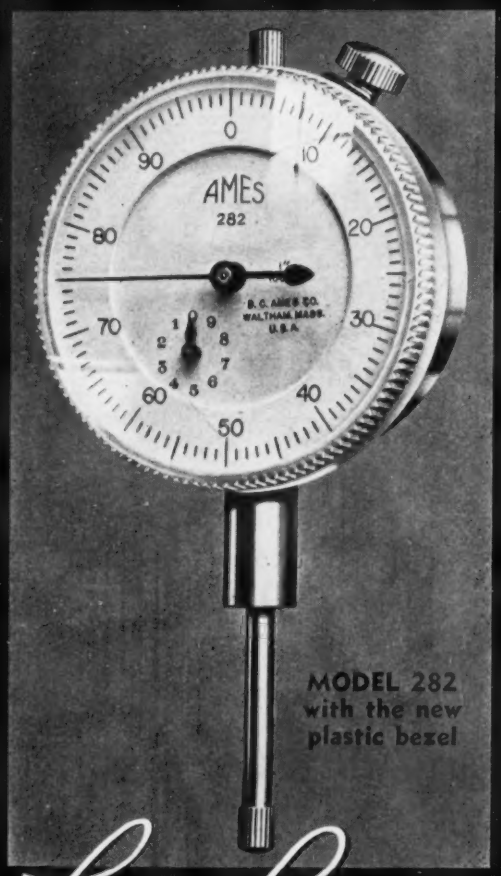
It will pay you, as it is paying scores of other manufacturers, to use the Severance Tool Regrinding Service.

Severance

MIDGET MILLING CUTTERS AND REGRINDING

SEVERANCE TOOL CO. SAGINAW MICHIGAN LONG ISLAND CITY N.Y. DETROIT FT. WAYNE IND. CHICAGO LOS ANGELES

AMEs



Long Range
DIAL INDICATORS

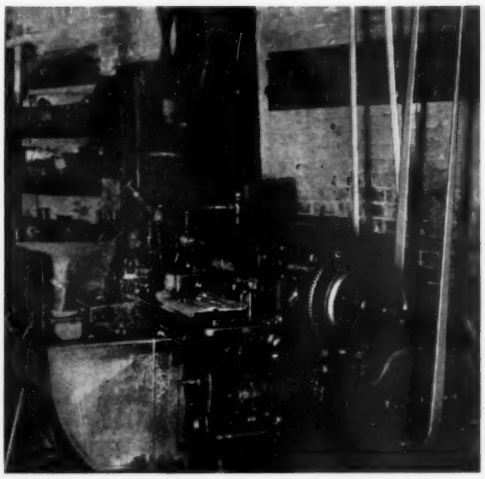
For greater range when testing long tapers and in extensometer work, Ames Indicators having spindle travels up to one inch are commonly used.

The Plastic Bezel eliminates shadows and relieves eye strain. A new feature exclusive with AMES.

Send for catalog.

B. C. AMES CO.
WALTHAM, MASS., U. S. A.

WHAT A DIFFERENCE THE BELTS MAKE! *TANNATE* GIVES YOU MORE PRODUCTION WITHOUT MORE MACHINES!



TANNATE leather belting gets extra production from almost any plant . . . For, Tannate carries full load; grips tightly, runs smoothly; keeps machines producing at full capacity even under varying load conditions.

TANNATE retains its unusual grip and great strength, even when exposed to high temperatures, machine oils, humidity, or weak chemicals. It has plenty of stamina for three-shift, seven-day-a-week operation. Tannate leather belting requires little attention other than an occasional application of Rhoads belt Preserver.

Let us help you keep all your machines running at full capacity. Watch Tannate increase your output, reduce your production costs!

STEP UP PRODUCTION with

RHOADS *Tannate* WATERSHED LEATHER BELTING

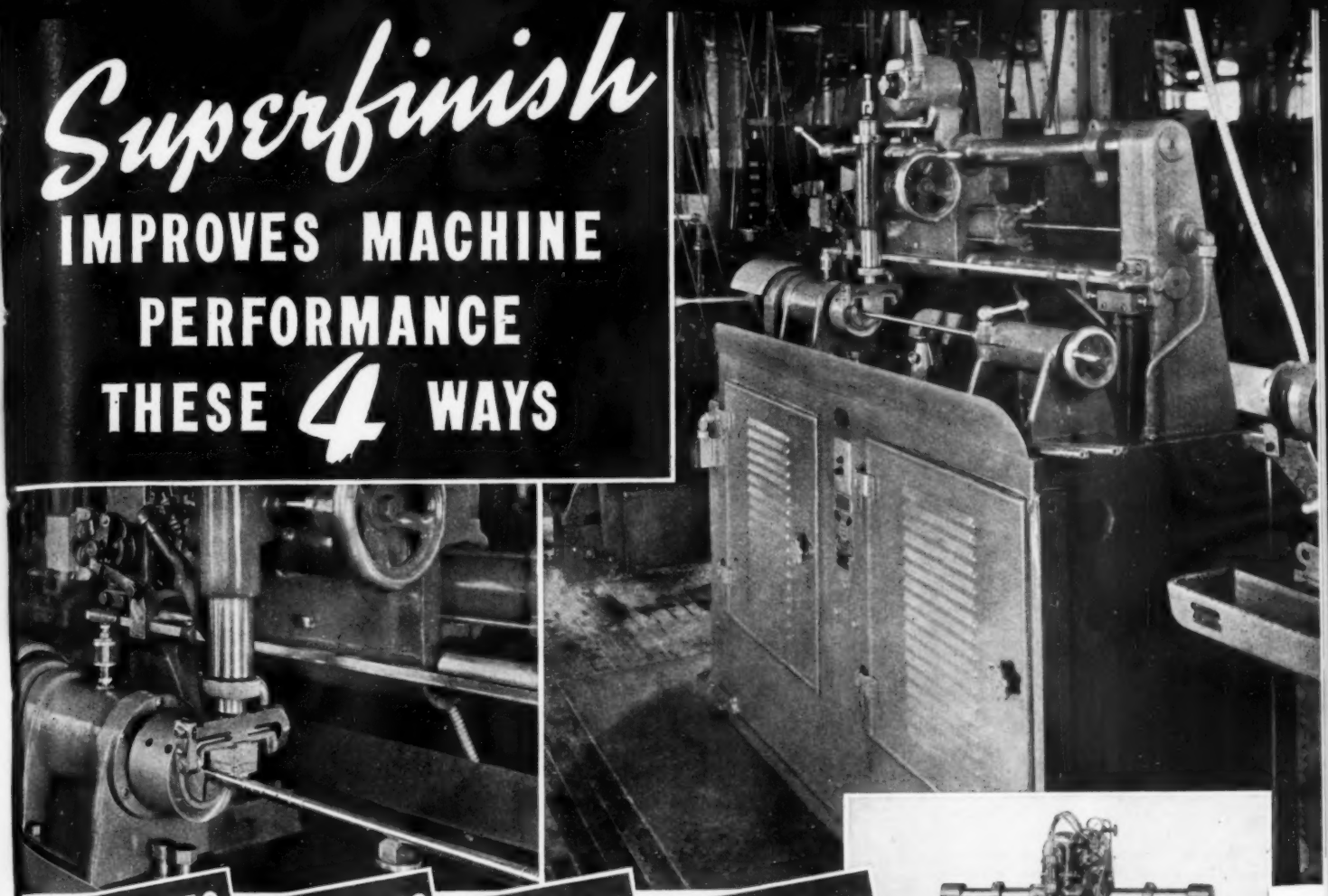
—Established 1702—

J. E. RHOADS & SONS

35 N. SIXTH ST. PHILADELPHIA, PA.

NEW YORK • CHICAGO • ATLANTA • CLEVELAND

Superfinish
IMPROVES MACHINE PERFORMANCE THESE 4 WAYS



ELIMINATES RUN-IN PERIOD

ELIMINATES FRICTION HEAT

ELIMINATES BEARING WEAR

ELIMINATES VIBRATION AND CHATTER

(*Right*) Foster 4″ x 18″—4″ x 36″ General Purpose Superfinisher

Two drive spindles for sewing machines are superfinished on a Foster 4″ x 18″ General Purpose Superfinishing Machine with the above results. The main shaft is 16″ long x .57975″ dia., and the small shaft is .31275″ dia., and both are held within .0005″ tolerances after superfinishing. The main shaft is superfinished in 2 min. 20 sec., and the small shaft in 45 sec. floor-to-floor.

Foster builds two General Purpose Superfinishing Machines, sizes 4″ x 18″ and 4″ x 36″, which are designed to handle a wide range of cylindrical parts. They are capable of producing geometrically improved surfaces of 2 to 3 micro-inches as measured by a profilometer with .0001″ to .0002″ stock removal. This is of particular importance to small production shops and tool rooms.

Superfinish may be used to improve your product's performance, or it may serve to eliminate bearing troubles that have been causing you excessive service expense. International Engineers will be glad to discuss the application of Superfinish to your products and make recommendations without obligation.

Foster also builds Flat Surface, Special Superfinishing Machines, and four sizes of Superfinish Attachments for mounting on engine lathes and turret lathes.

GET THIS FREE BOOKLET

Superfinishing data explains advantages and many uses. . . shows extensive line of general purpose and special machines for miscellaneous or production superfinishing. Write to International Machine Tool Corporation, Foster Division, 1100 W. Beardsley Ave., Elkhart, Indiana.

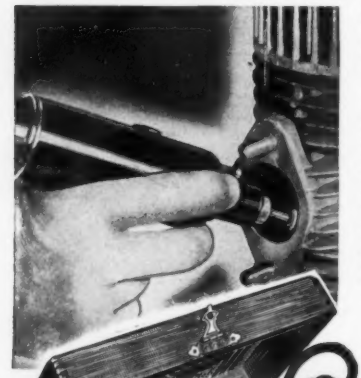
INTERNATIONAL MACHINE TOOL CORPORATION

FOSTER DIVISION, ELKHART, INDIANA · LIBBY DIVISION, INDIANAPOLIS, INDIANA

MAIN OFFICE AT ELKHART, INDIANA

FOSTER FASTERMATICS · LIBBY HEAVY DUTY TURRET LATHES · STANDARD TOOLS
SUPERFINISHING MACHINES · BARKER CHUCKS · UNIVERSAL RAM TYPE TURRET LATHES

DREMEL MOTO-TOOLS SPEED UP WAR PRODUCTION



Dremel Moto-Tools are speeding up war production in defense plants from coast to coast. These rugged tools tackle grinding, routing, buffing and finishing jobs with speed and precision . . . faster and easier, in close quarters . . . in hard-to-get-at places.

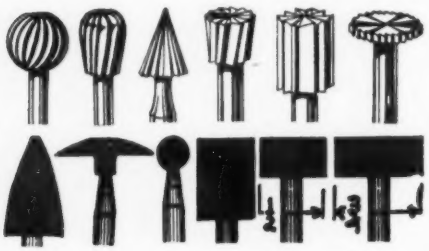
A Dremel Moto-Tool has a shock-proof bakelite housing, oil-sealed bearings, and a balanced armature to eliminate vibration and produce finer finished surfaces. It weighs only 13 ounces . . . can be hooked up to any AC or DC outlet. Used in America's leading arsenals of democracy . . . by General Electric, Westinghouse, Remington Arms, Ford, Nash-Kelvinator, Consolidated Aircraft, Douglas Aircraft, Northrop Aircraft, and many others.

Below: Tool makers find Moto-Tool's sensitive, finger-tip control indispensable when shaping intricate or irregular metal dies. For grinding or cutting with steel accessories . . . it can't be beat for convenience.

Above: Moto-Tool is ideal for getting into close quarters, grinding, buffing and finishing to required specifications. For metal, wood, plastics, porcelain, glass, and other materials.

27,000 R.P.M.

This complete Moto-Tool kit has accessories for all types of grinding, buffing and finishing operations . . . with steel cutting tools and the best abrasives. Consists of 1 Model 2 Moto-Tool with three collets:— 1/8", 3/32", and 1/16", 4 Emery Wheel Points, 1 Dressing Stone, 8 Carving Cutters, 1 Steel Saw, 3 Bristle Brushes, 1 Steel Cleaning Brush, 1 Screw Mandrel with Sanding Discs, and 1 Shoulder Mandrel, one 1/2" Drum Sander. Packed complete in sturdy felt-lined hardwood cabinet case . . . $23.50. Dremel No. 2 Moto-Tool, $16.50.



Dremel emery wheel points, steel cutters and accessories with 1/8" shanks are available for quick delivery in a wide variety of sizes and shapes. They can be used with practically all makes of hand grinding tools. Write for catalog.

10 DAY TRIAL

Try a Dremel Moto-Tool for 10 days in your own shop. See how versatile, how indispensable it can become to fast, accurate work. Order from your industrial distributor, or contact any of the following representatives:

WEST COAST
The Federated Sales Co.
2437 West Valley Blvd.
Alhambra, Calif.

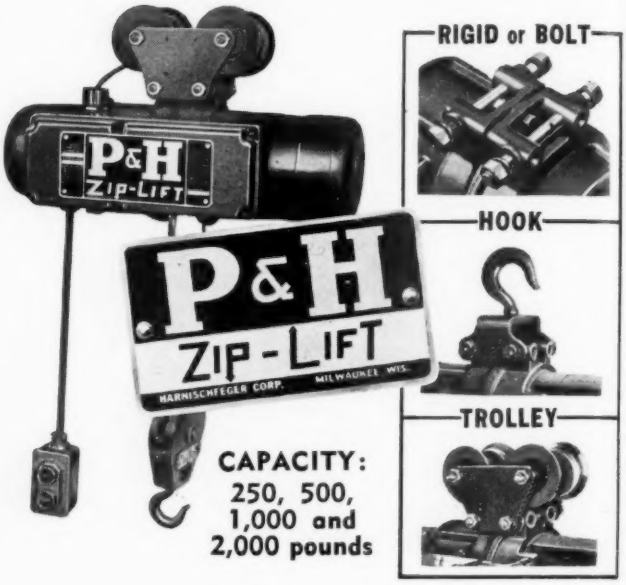
METROPOLITAN NEW YORK
Mill Factor Products Co.
53 West Broadway
New York, N. Y.

NEW ENGLAND
F. V. Fowler, 116 Dartmouth St., West Newton, Mass.

DREMEL MFG. CO., Dept. T473-M, Racine, Wis.

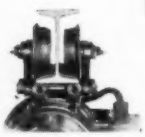
CONVERTED IN A FEW MINUTES

with any of these 3 mountings



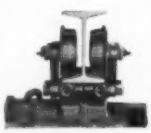
● Do you face the war-time need of converting your hoists for other services? The interchangeable mountings of P&H Zip-Lifts require but a few minutes to change to any of the three mountings shown — merely loosen two bolts. All mountings are jig-drilled to identical centers to assure a firm, safe attachment, free from wobble.

In the interests of speeding war materials handling, consult P&H Field Representatives on every hoisting problem. Zip-Lift users will find their counsel especially helpful in planning more flexible and efficient hoisting facilities.



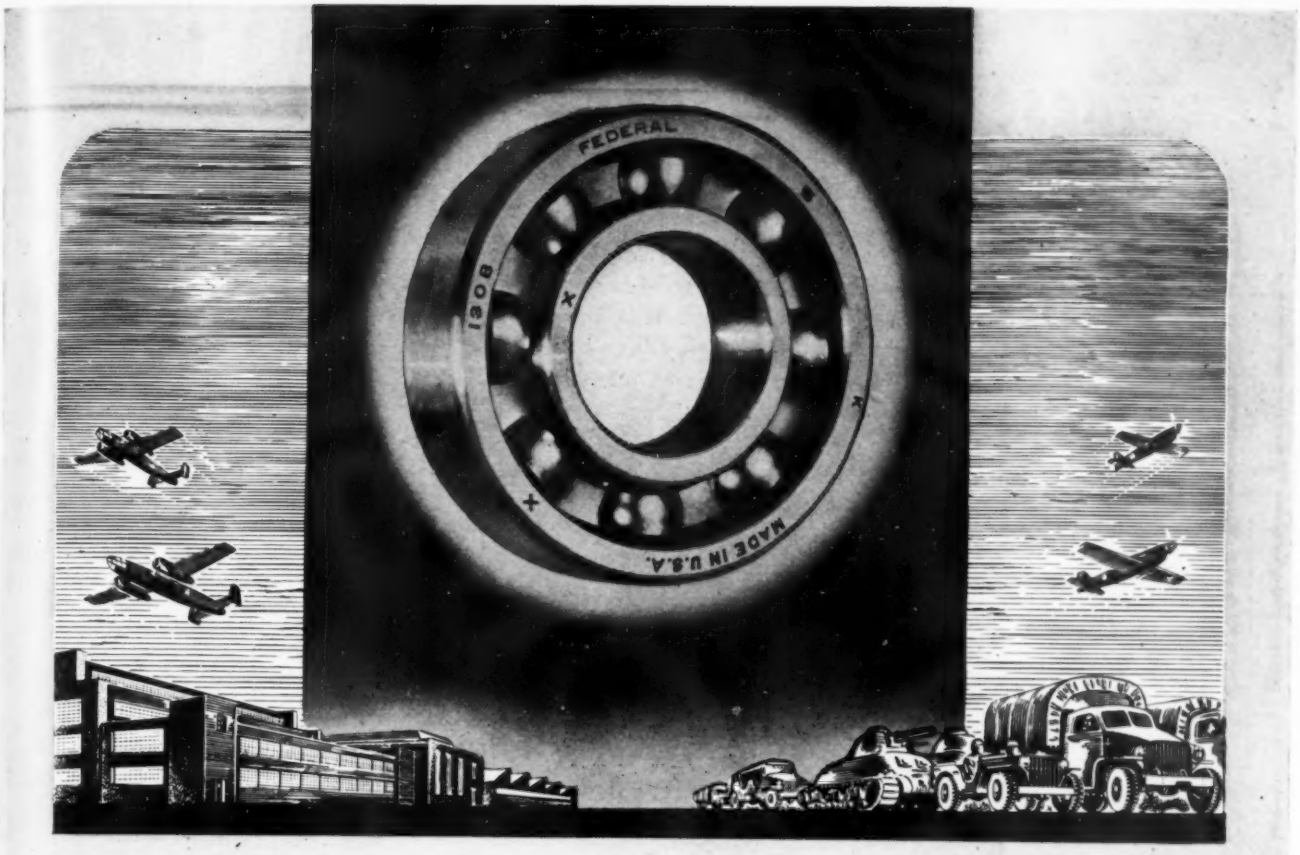
PARALLEL OR CROSS-MOUNTED

in addition to quick interchange of type of suspension, P&H Zip-Lifts are also easily mounted with hoisting drum either parallel or horizontal to runway beam. This provides widest latitude of pull in the direction desired.



General Offices: 4514 W. National Avenue, Milwaukee, Wisconsin

HARNISCHFEGER CORPORATION
HOISTS · WELDING ELECTRODES · MOTORS P&H EXCAVATORS · ELECTRIC CRANES · ARC WELDERS



FEDERAL

BEARINGS

TRADE MARK

Federal is doing an outstanding job—in war production, industry and in Uncle Sam's mechanized vehicles at home and abroad . . .

●

For the duration we are unable to supply many types of bearings formerly manufactured

THE FEDERAL BEARINGS CO., INC.

Makers of Fine Ball Bearings

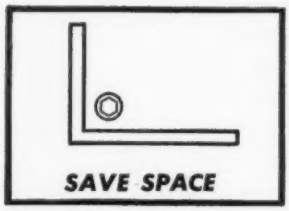
U. S. A.

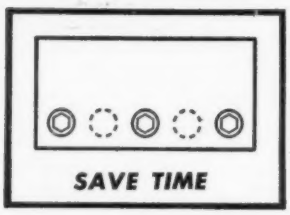
REPRESENTATIVES LOCATED AT

Detroit: 2640 Book Tower • Cleveland: 402 Swetland Building

Chicago: 902 S. Wabash Ave. • Los Angeles: 5410 Wilshire Blvd.

Yes, these screws save Time and Space!





No matter how close to a corner or flange you put Mac-it hexagon socket screws, there's plenty of room to drive them. This feature saves space.

★ ★ ★

Mac-its are heat-treated to give far greater strength than plain steel screws. With that extra holding power, you may be able to use fewer screws—save drilling and tapping time.

★ ★ ★

Production tie-ups because of broken screws are not necessary evils. Chances are that standard Mac-its will solve the problem.

Mac-its

PRONOUNCED "MACK-IT"

4311

OTHER MAC-IT PRODUCTS INCLUDE:

Socket head and hexagon head cap screws, stripper bolts, hollow and square head set screws, hexagon socket pipe plugs.

Strong, Carlisle and Hammond Company

Cleveland • Ohio

OUT OUR WAY
BY J. R. WILLIAMS
SAY, I'D LIKE TO HAVE A COUPLA DAYS OFF TO GET FITTED FER A NEW SET O' CHOPPERS...
NOW DAVE? NOW? WITH THIS WAR WORK-- THIS RUSH-- THIS UH--
DAVE'S RUN THAT OLD LATHE FER 30 YEARS WITHOUT A DAY OFF-- WHY DIDN'T HE GET HIS STORE TEETH WHEN THINGS WEREN'T SO BUSY?
WELL, TH' LAST WAR THEY WAS TOO BUSY-- AN' HE DON'T THINK HE KIN LAST TILL TH' NEXT ONE-- AN' WAR TIME IS THE ONLY TIME HE MAKES ENOUGH TO AFFORD A NEW SET O' MEAT-GRINDERS!
BOOM TIMES
J.R.WILLIAMS

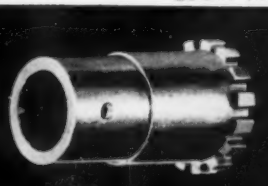
The 'Old Bull's' got his hands full...

...and so has every one of us working and fighting for Victory and the Four Freedoms. *Today, war production is everything.* Out of this great victory drive are coming new techniques and skills, new materials, new products which will help make the world a better place to live in when peace is won. The lowered costs, for instance, that will result from new methods of mass production will make available to everybody the wonders industry is readying for peacetime. The constructive thought we give to post-war problems *today* will be our assurance of a sound and lasting economy after victory.

(*Below*) A few of the many thousands of our precision-made parts that help "Keep 'em flying and fighting."

ERICSSON

ESTABLISHED 1911



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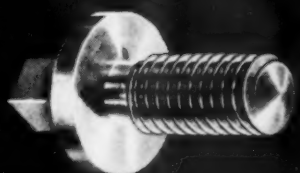
SCREW MACHINE PRODUCTS CO., INC.

25 LAFAYETTE STREET, BROOKLYN, N Y



"SPIRAPOINTS"

The Newer, Quicker Way to Sand Recesses in Metal

Another important "Gadget" of METALITE CLOTH

The very newest coated abrasive development for the faster mechanical finishing of bothersome metal parts. "Spirapoints" are particularly effective on those low areas of varying radii that defy hand sanding except at enormous loss of time.

These *tapered* ready-to-use abrasive cloth "gadgets" constantly offer new sanding surfaces, possess just the right resiliency and can do a wonderful job right in your plant.

On your present portable or flexible shaft tools they will astonish you with their speed and uniformity of output, doing in seconds jobs that formerly took minutes—and doing them better.

Furnished in full range of grit numbers and in many other shapes than the few shown below.

Inquiries for samples and demonstration welcomed.

•

A request on your letterhead will bring you a handsome wall chart in three colors, illustrating the full line of Metalite Cloth "Gadgets" and showing typical operations.

BEHR-MANNING • TROY, N. Y.

(DIVISION OF NORTON COMPANY)

Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Grand Rapids, High Point, Indianapolis, Los Angeles, New York, Philadelphia, St. Louis, San Francisco, Tacoma

WILLARD *Spring* TOOL HOLDERS

...modern aids to speeded-up war production!

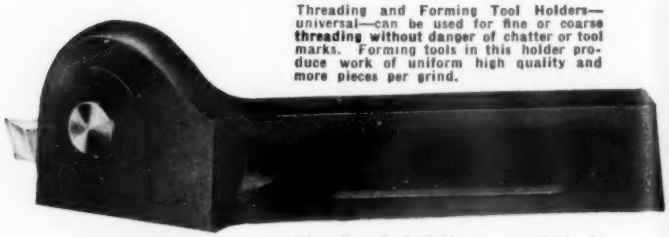
These time and work-saving tool holders are especially adapted to repetitive, fast, precision production work. Their ever-widening acceptance in plants busily engaged in war work is outstanding recognition of their ability to eliminate chatter and protect cutters from breaking as well as to insure against damaged work.

WILLARD TOOL HOLDERS are available for every cutter need. Prompt deliveries.

INVESTIGATE TODAY

for ALL SERVICES

Forming Tool Holders, Threading Tool Holders, Cutting-off Tool Holders, Threading and Forming Tool Holders.



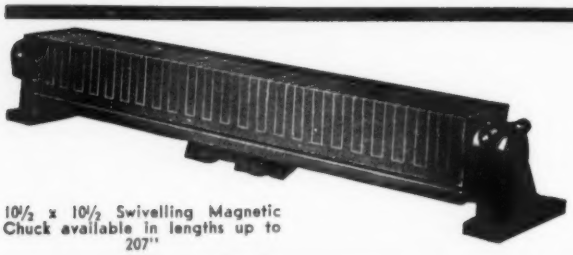
Threading and Forming Tool Holders—universal—can be used for fine or coarse threading without danger of chatter or tool marks. Forming tools in this holder produce work of uniform high quality and more pieces per grind.

Threading Tool Holders — available in straight and right-hand offset types. No fitting to gauge when grinding; no adjustment in tool post after grinding; threads close to shoulder; produces smooth accurate threads.

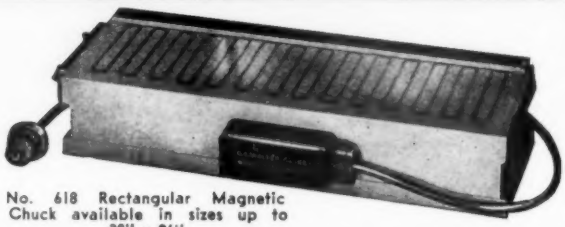
Product of AUTO-ORDNANCE CORPORATION

TRADE MARK Thompson REG. U.S. PAT. OFF.

1437 Railroad Ave., BRIDGEPORT, CONN.



10½ x 10½ Swivelling Magnetic Chuck available in lengths up to 207"



No. 618 Rectangular Magnetic Chuck available in sizes up to 30" x 96"

Your every need can be met with

WALKER MAGNETIC CHUCKS

Aside from the fact that Walker Magnetic Chucks are of tried and proved design and construction, the big advantage in coming to Walker for your needs is the fact that you can be certain that you will exactly meet your needs. Regardless of your requirement, there's a Walker to handle it.

The completeness of the Walker Magnetic Chuck line makes it possible for you to standardize on these well-known and widely accepted units. Every type of magnetic chuck is available in a wide range of standard sizes including Rectangular, Swivelling, Vertical Face and Rotary. Every design is modern, convenient, with maximum uniform magnetic strength over the entire surface.

Get all the details pertaining to sizes, types and construction by wiring today for a copy of Bulletin W4.

Also

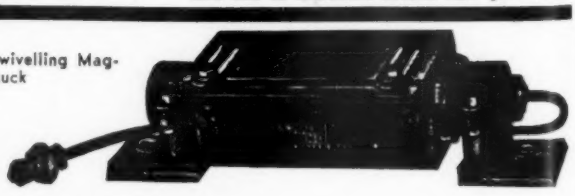
Walker is prepared to furnish promptly and at reasonable price any special magnetic chuck that may be required for special service conditions. Outline your problem and ask us to submit details and quotations.

DEMAGNETIZERS

Send for a copy of Bulletin K7 giving complete information on Walker D.C. and A.C. Demagnetizers. These units —in 110 and 220 v.—are suitable for removing residual magnetism from a wide variety of work, are convenient and highly efficient.

Style B Face Plate for Standard Rotary Type Chucks available in sizes up to 66" diam.

No. 410 Universal Swivelling Magnetic Chuck



O. S. WALKER CO. Inc., Worcester, Mass.

How a Woman's War Idea Saved a Year of Man-Hours

MRS. Bonny Smith Lewis, 21-year-old war worker at RCA Manufacturing Company's plant in Indianapolis, had an idea . . . an idea for increasing her company's production of a certain plastic part for military telephone equipment.

The flashing left on this part by the molding process was being removed by hand scraping. Mrs. Lewis' idea was that it could be removed much faster with a wire brushing wheel. The company tried her idea and adopted it.

When the War Production Board conferred awards upon workers whose ideas for improving quality or quantity of war production had proved most valuable they selected 16 men and one woman for top honors. The woman was Mrs. Bonny Smith Lewis. Her idea had saved 2925 man-hours—more than a year's work. In addition, the quality of the product was improved.

Naturally we're proud that the brushes used were made by Osborn. But our tribute here is to America's growing army of women war workers. They've tackled the biggest job they've ever faced. They are doing that job with determination, perseverance and intelligence.

In the final accounting, the contribution of American women to their country's cause will rank with the highest. *The Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland, Ohio.*

Osborn Brushes

WORLD'S LARGEST MANUFACTURER OF BRUSHES FOR INDUSTRY

"Blount" The NEW MODEL K BUFFER and POLISHER

Speeds production through easy handling

This new Blount contribution provides offset wheel shafts and overhang toward operator, making it easy to work at. Plenty of room is available for swinging work to be polished. Fewer parts requiring attention assure easy operation; ample foot room reduces fatigue by enabling operator to stand erect at his work; streamlining simplifies cleaning.

Other features include:

. . . heavy rigid, smooth base construction.

. . . motor mounted in air-flow base; special enclosed or drip-proof motors not required.

. . . easily accessible and adjustable V-belt drive completely enclosed for maximum safety within column.

. . . spindle lock for holding spindle when changing wheels.

. . . positive grease-sealed bearing assemblies.

COMPLETE DETAILS AVAILABLE ON REQUEST

CONDENSED SPECIFICATIONS . . .

Height floor to spindle center—38"
Spindle length overall—53"
Spindle extension, each side—10¾" (optional)
Spindle bearings—Simplex "Cartridge-Type"
Spindle revolutions (optional)
Motors—2, 3 and 5 H.P.
Base 28" x 24"

J. G. BLOUNT COMPANY *Everett, Mass., U.S.A.*

BORITE—for all kinds and classes of steel grinding.

CARBORITE—for all classes of cast iron, brass, bronze and aluminum grinding.

Also, Silicate, Shellac and Resinoid Bonded Wheels.

Vitrified

Cuts longer between turns

Vitrified Grinding Wheels assure economy in high quantity production fine precision grinding because they cut longer between each wheel truing. Then, too, these long life, strong wheels require less redressing. They can also be depended on to eliminate gumming, glazing and heating.

All these advantages are available regardless of the grinding job, because there is a size, shape and type Vitrified Grinding Wheel for every grinding purpose. The completeness of the Vitrified line makes it possible for any shop to standardize on Vitrified Wheels.

Our engineers will gladly study your grinding operations and point out the savings you can make through the use of Vitrified Wheels.

VITRIFIED

VITRIFIED WHEEL COMPANY
WESTFIELD MASS.

How to Solve Production Problems

with Delta Low-Cost DRILL PRESSES

No. 1370 —Floor type 17-inch "Slo-Speed" Delta drill press with No. 2 Morse Taper Spindle and standard tilting table. Shown with motor.

Many problems that stump production men have been successfully solved with Delta Drill Presses. This has been definitely proven in thousands of cases—on a large variety of operations. Today, these efficient, flexible machines are being used in thousands of plants not only as production line equipment—but as auxiliary machines, special purpose machines, for special set-ups and tool room equipment.

Throw overboard your notions of what can be accomplished with standard drill presses —and get the full details of this remarkable story. You will be in for a distinct surprise!

Ask your Delta Industrial Distributor for Full Details

Your nearest Delta Industrial Distributor is personally acquainted with many actual installations of Delta drill presses in your vicinity. He has photographs and full details showing how Delta drill presses have been used to solve a wide range of production problems. Also ask him for recent issues of "Tooling Tips" which tell in complete detail ingenious and unusual adaptations of Delta machines.

DELTA MILWAUKEE

THE DELTA MANUFACTURING COMPANY
608-B E. Vienna Avenue, Milwaukee, Wis.

Gentlemen: ☐ Send me name and address of Delta Industrial Distributor in my locality.
☐ I want to receive "Tooling Tips" as issued.

Name .....

Address .....

Firm .....

City ..... *State* .....

SEED MONEY *will*

(This advertisement appeared in a group of newspapers on Tuesday, January 26, 1943)

WE DOUBT if a guy in a tank has much time to worry about how he is going to make a living when the war is over. That's the duty of the folks at home.

Thoughtful men in political life are beginning to talk about the need for assuring jobs not only for returning fighting men, but also for the millions who have found work in war production.

Vice-President Wallace has summed up the yearnings which all of us feel for a better world to follow this war in his phrase, "The Century of the Common Man."

► We think he means that if all of us can find fruitful work to do, we will enter upon a new era of happiness that grows not only from material well-being, but from a sense of personal accomplishment.

No one could ask for a better grasp of the objectives that stir the souls of men than has been shown by the leaders of both of our political parties.

The only difference of opinion that could possibly exist on such noble objectives is in the method by which the common man can be given his century.

► Most business men know that jobs and good wages make good business.

Most wage earners know that business must be healthy if it is to support good pay and give a job to everybody who wants to work.

Where we run into trouble is that we don't hold on to these simple facts when we make our laws.

If a law helps business, it helps the worker.

If a law SAYS it helps the worker, but really *hurts* business, it can never have the effect for which it was intended.

That isn't the fault of business. It's just another evidence of the supremacy of common sense.

► *Here's a simple formula for making jobs after the war:*

1. Remember that the United States invented machines and manufacturing methods that have given the highest standard of living in the world.

2. Good wages and good living result from
   a. More output per worker
   b. Less cost per unit produced
   c. Lower prices to consumers

3. Therefore, the only way to live better is through constant improvement in our machines and methods.

4. However, it is a natural political tendency to try to legislate good living. This cannot be done, except as legislation promotes sound industrial progress. *Industrial progress, not legislation, is the source of all good living.*

ll make jobs for soldiers

5. But good living depends upon constant development and use of new and better machines and methods. These things cost money.

6. Money for new machines and better methods must come out of the profits of business. (This reinvested profit of business is called SEED MONEY.)

7. To prevent a crop of war millionaires, Congress passed a law which not only accomplishes that objective, but also takes away SEED MONEY which business will need after the war.

8. If you want to see that every ambitious man has a chance to work after the war, write your Congressman and remind him that private profit and the SEED MONEY of business are two entirely different things. Business should be allowed to accumulate more SEED MONEY, for making post-war jobs. Lawmakers help make good living for you when they make laws that make good business. At the same time they create the best insurance for the Century of the Common Man.

"What's Good for Business is Good for Americans"

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

22 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL

PUBLISHING COMPANY, INC. . . . 330 WEST 42ND STREET, NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

American Machinist • Aviation • Bus Transportation • Business Week • Coal Age • Chemical & Metallurgical Engineering • Construction Methods • Electrical Contracting • Electrical Merchandising • Electrical West • Electrical World • Electronics • Engineering & Mining Journal • E. & M. J. Metal and Mineral Markets Engineering News-Record • Factory Management & Maintenance • Food Industries • Mill Supplies • Power • Product Engineering • Textile World • Wholesaler's Salesman • Affiliated with Business Publishers International Corporation, publishers of Business and Technical Magazines for Latin America, and Overseas Circulation.

CARD TAPS

ARE YOU INTERESTED IN BETTER TAPPING?

If better production tapping is your objective, it will be to your advantage to come to Card. We can help you because we sell better tapping performance.

The high quality of work done—the quantity produced—the economy of using Card Taps—will be apparent on any tapping job. Just put Card Taps to work and let them prove their superiority.

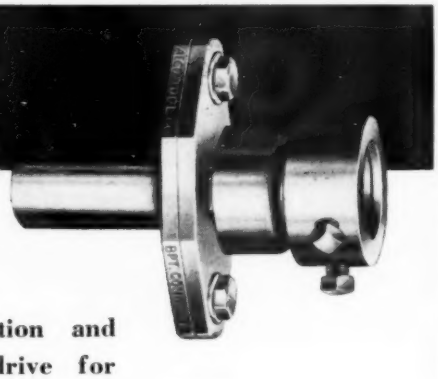
A regular catalog tap in most cases will meet your needs without using special taps. You'll find your requirements covered in the Card Catalog No. 34. Write for a copy.

Card taps are sold by leading dealers everywhere

S. W. CARD MANUFACTURING CO.
Mansfield, Mass., U. S. A.
DIVISION OF UNION TWIST DRILL CO

STORES: New York: 61 Reade St., Chicago: 11 South Clinton St., Detroit: 6540 Antoine St., Seattle: 568 First Avenue, South Los Angeles: 168 South Central Avenue San Francisco: 121 Second St.

ALCO RELEASING MODEL BUTTON TYPE DIE HOLDER



Alco presents a revolutionary improvement in a releasing type holder with concentric alignment for button dies for use on hand screw machines and turret lathes.

If there's room for improvement in the work you are doing—if your set-up time is running higher than it should—and if your production is lagging behind today's faster tempo, we assure you that ALCO Tools are playing a big part, both here and in England, in getting top speed out of every thread cutting operation.

This latest addition to the ALCO line incorporates all the time-tested features of the now famous ALCO drill chucks and tap and die holders PLUS rigid construction and solid clutch drive for this releasing model. Will cut left or right hand threads equally well without any internal changes in the mechanism . . . longer die life, quicker set-up, perfect threads on each piece and thruout the run.

Write Alco your particular thread cutting problem. Send for the latest Alco catalog illustrating the complete line of Alco holders for screw machines both old and new.

ALCO EFFICIENT TOOLS

The Alco Tool Company, 353 Birdseye St., Bridgeport, Conn.
DETROIT OFFICE—908 STEPHENSON BLDG.

Tool Conservation Begins in the Tool Crib

Photographs Courtesy Weatherhead Company, Cleveland, Ohio

WITH GAGES IT'S *System*

Before a gage is returned to the storage rack, it is thoroughly checked and inspected, and any adjustments or repairs needed are made or ordered.

Felt-lined individual compartments protect the gages from injury and provide a practical visual check on the gage stock.

Metal check method of issuing and card record of stock condition, with carefully trained attendant, assure positive control of entire gaging system. This "Tool Crib" is air conditioned.

Well-equipped factories in mass production industries do not select their gages haphazardly or just by chance. Their gaging systems are completely integrated and adapted to their particular requirements. But no matter what a plant's gaging needs, all gaging systems should include at least three fundamental features:

1 **Adequate checking and measuring equipment** — gages need constant checking for significant wear, damage or tampering.

2 **Convenient, safe, systematic storage** — poor storage conditions can ruin gages even before they are used once, and a lost or misplaced gage means loss of valuable time as well.

3 **A positive accounting method** — when new gages are needed, they are usually needed badly, therefore proper accounting for every gage at all times avoids disruption of the gaging system through delays in anticipating requirements.

GREENFIELD TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS
DETROIT PLANT: 5850 Second Boulevard
WAREHOUSES in New York, Chicago and Los Angeles
In Canada:
GREENFIELD TAP AND DIE CORP. OF CANADA, LTD., GALT, ONT.

ARMY E NAVY

GTD GREENFIELD

TAPS · · · DIES · · · GAGES · · · TWIST DRILLS · · · SCREW PLATES

VALUABLE INFORMATION for all users of

Ettco-Emrick TAPPING ATTACHMENTS

IN THE NEW BULLETIN No. 2-S

All production tools today, must be kept in working order and made to last as long as possible. This means they must be used correctly and given proper care.

As a service to users of our Ettco-Emrick Tapping Attachments we have prepared a bulletin which tells how to get maximum service from these high-speed, sensitive units. It also includes a table giving maximum operating speeds, maximum tap capacity in steel and lubrication instructions for every one of the seven sizes.

The bulletin also contains a complete list of parts of the different sizes giving correct part names and identification numbers. With this information you can avoid delays and errors in ordering parts that may be needed.

Every user of Ettco-Emrick Tapping Attachments should send for this bulletin. A copy will be mailed on request. Ask for Bulletin 2-S.

IMPORTANT

TO NON-USERS

If you need more tapping production without more machines, just clamp one of these Ettco-Emrick Attachments to the spindle of any drill press and presto — you have a high-speed, sensitive, accurate tapping machine —without altering the press in any way. 7 sizes for No. 0 to 1" taps. Bulletin No. 2 gives details. Write for a copy today.

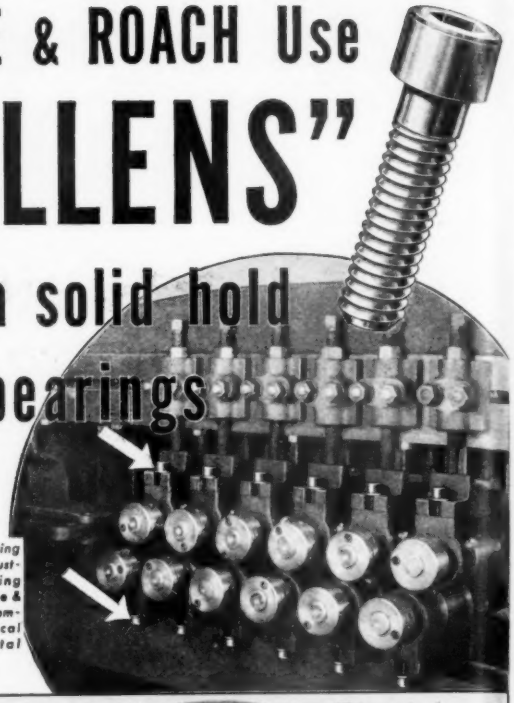
ETTCO TOOL CO.

590 Johnson Ave., Brooklyn, N. Y.

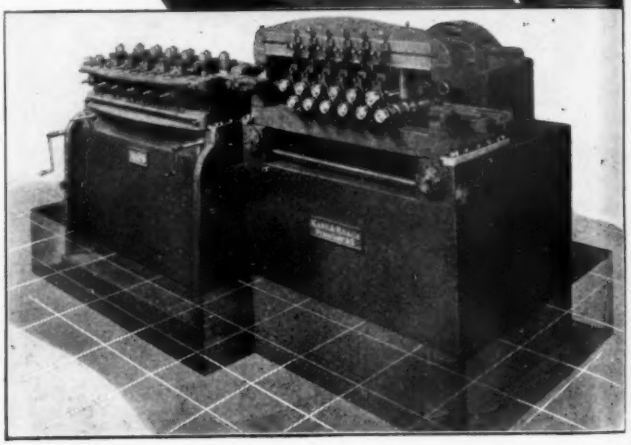
Detroit ● Chicago

The Famous Ettco-Emrick DRILL CHUCKS • TAP HOLDING CHUCKS
TAPPING ATTACHMENTS • TAPPING MACHINES
MULTIPLE SPINDLE TAPPING AND DRILLING HEADS
Unexcelled for Design, Materials and Workmanship

KANE & ROACH Use "ALLENS" for a solid hold on bearings



Close-up of bearing supports and adjusting screws holding roll shafts in Kane & Roach No. 88H Combination Vertical and Horizontal Straightener.



This KANE & ROACH "BBH" Combination Vertical and Horizontal Straightener does fast, versatile work in straightening squares, flats, hexagons, octagons, channels and numerous special and structural shapes. The 24 roll shafts are power-driven, and *adjustable lengthwise* of the stock being straightened. This allows the machine to be adjusted for the best longitudinal roll spacings for the type of section to be straightened.

Convenient adjustment of roll shaft bearings must be clinched with the solidest possible set-ups for accurate alignment. ALLEN *"pressur-formd"* Socket Head Cap Screws are handily and rigidly set up with hexagon keys. They HOLD the bearing supports in a grip that never works loose.

Allen is proud of its tie-in with the famous performance of Kane & Roach machines. Hollow screws are little things to these builders of steel mill equipment. But their exacting selection of little things confirms the quality of the bigger things in Kane & Roach construction.

THE ALLEN MFG. COMPANY
HARTFORD, CONNECTICUT, U. S. A.

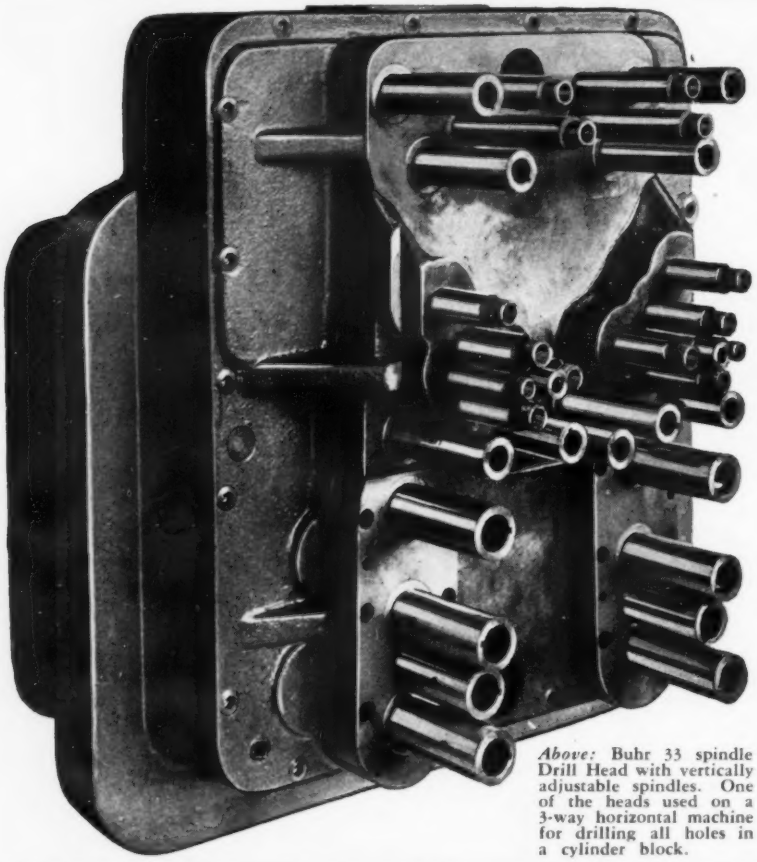
Twist Drills · Milling Cutters
Taps · Dies · Reamers · Drill Chucks
Wheel Dressers · Special Tools

STANDARD TOOL CO.

THE STANDARD TOOL CO.

CLEVELAND

NEW YORK • DETROIT • CHICAGO



Above: Buhr 33 spindle Drill Head with vertically adjustable spindles. One of the heads used on a 3-way horizontal machine for drilling all holes in a cylinder block.

If it is a Multiple Production

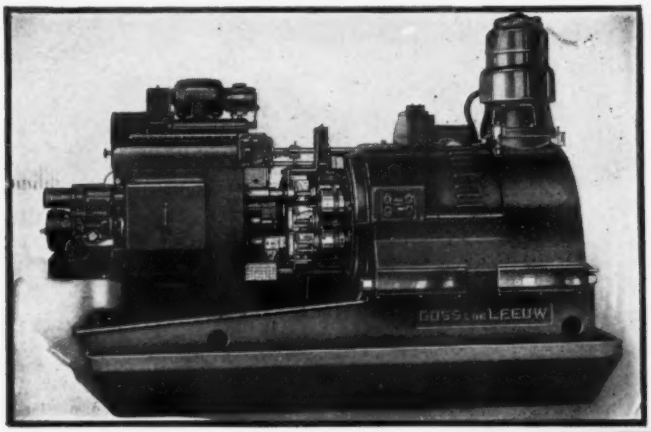
Buhr

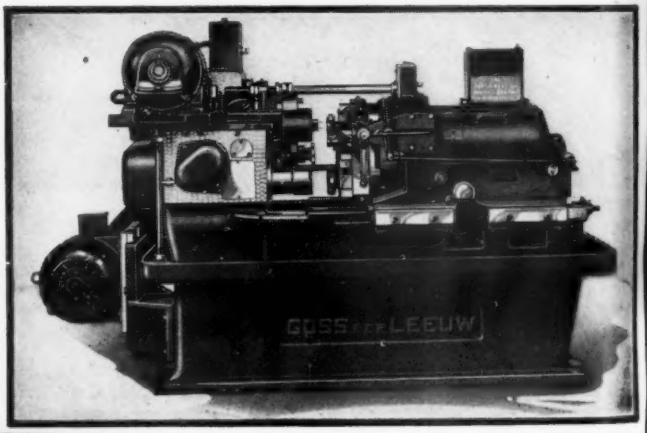
DRILL HEAD, it is good for 24 hour Production

• This is but one of many BUHR-designed drill heads now being used in night and day production to supply our fighting forces. Similar applications of BUHR Multiple Spindle Drill Heads *will* speed your work. Give them a trial in your plant. Send us your blueprints—we'll make suggestions and recommendations on the use of BUHR-engineering and equipment.

BUHR MACHINE TOOL CO.
ANN ARBOR, MICH.

Specialists in Multiple Spindle Drilling, Boring, Reaming, Tapping Equipment





WORK ROTATING TYPE

5 Spindles
6 Spindles
8 Spindles

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES

TOOL ROTATING TYPE

4 Spindles
5 Chucking Positions

On these machines, two threading operations can be handled simultaneously, each thread controlled by its own lead screw.

Among the many other modern features offered in both types are: pre-loaded anti-friction spindle bearings, hardened ways, oversize spindles and gears of chrome-nickel steel, heat-treated.

Complete details will be found in descriptive catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

CHANGE TOOLS WITHOUT STOPPING MACHINE

with

MODERN-MAGIC QUICK CHANGE CHUCKS

Increase production by eliminating the necessity of stopping spindle to change tools. With Modern Magic Chucks, tools can be changed with spindle revolving at operating speeds—or sequence of operations can be performed with the spindle revolving continuously.

Various size tools or groups of tools can be used with Modern Magic Chucks and Collet Equipment. Note the variation in size of the drills being used on the set-up shown above.

The simple design of these chucks makes them practically trouble free and their durable construction insures long life. Bulletin M-101 giving complete information on Modern Magic Chucks will be mailed on request. Send for your copy.

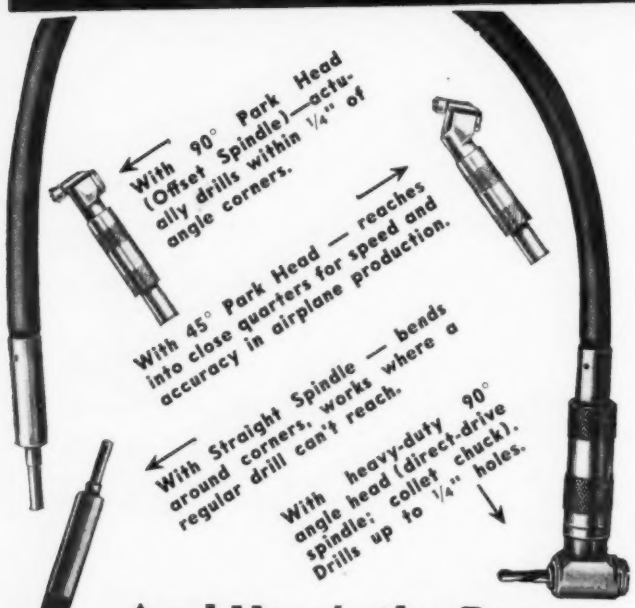
CONSOLIDATED MACHINE TOOL CORPORATION

MODERN TOOL WORKS

DIVISION

ROCHESTER, NEW YORK

Here's the Advantage of STOW FLEXIBLE DRILL SHAFTS


With 90° Park Head (Offset Spindle)—actually drills within 1/4" of angle corners.
With 45° Park Head — reaches into close quarters for speed and accuracy in airplane production.
With Straight Spindle — bends around corners, works where a regular drill can't reach.
With heavy-duty 90° angle head (direct-drive spindle; collet chuck). Drills up to 1/4" holes.

And Here's the Reason

Why One Aircraft Producer Has 4000 Stow Shafts on Active Duty

YOU CAN'T BEAT STOW DEPENDABILITY! Pioneers of the flexible drill shaft, Stow for 67 years has developed and perfected this valuable extension that simply fits into your electric drill chuck. It's made to stand up under heavy-duty use for long, tough service. The protecting case is rugged and durable, with permanent-grip end-pieces . . . and the core is strong and long-wearing—as only Stow can make it! Look into all the possibilities STOW can offer you—write today for the new Stow Literature that outlines many new uses, gives all data!

For Steady Service—Specify STOW!

STOW MFG. CO., Inc.

29 Shear St., Binghamton, N. Y.

STOW Flexible Shaft Machines

Complete line of heavy-duty and junior portable models for grinding, filing, drilling, sanding, polishing, wire-brushing, etc. Takes the machine right to the job! Ask us about these production hustlers!

Do you know gages and their proper use?

What is the proper kind of gage for a specific type of work? How are gages constructed? How are they used? Fred Colvin, out of his wide and intimate experience, has set down in a practical, workable manual the essential facts about gages of all types—how they are made, how to use them, which types are best for specific jobs, how to use them in inspection work.

Gages and Their Use in Inspection

By Fred H. Colvin

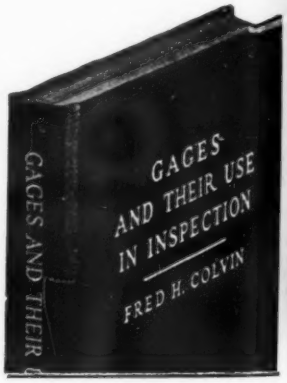
Editor Emeritus, *American Machinist*

157 pages, 5½x8, 71 illustrations, $1.50

This book describes all types of gages, from calipers, Verniers, Micrometers, Measuring Blocks, etc., up to the latest electrolimit gages. Tolerances, limits, and allowances are carefully defined and explained, and many practical kinks and suggestions on inspection are included.

Here is what the book covers—

1. Gages and How They Are Used
2. Measuring Instruments In Common Use
3. Types of Gage
4. Gage Tolerances and Gage Wear
5. Gage Blocks and Dial Gages
6. Reed and Air Gages
7. Threads and Thread Gages
8. Special Types of Gages
9. Interchangeable Manufacture and Inspection
10. Salvaging and Selective Assembly
11. Kinds of Fit



"A thorough understanding of gages and their use will make it easier for both workmen and inspectors, and it may easily open the way for a workman to graduate from the machine to the inspection department."

SEE IT 10 DAYS FREE—MAIL THE COUPON

McGRAW-HILL ON-APPROVAL COUPON

McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. C.

Send me Colvin—Gages and Their Use in Inspection for 10 days' examination on approval. In 10 days I will send $1.50 plus few cents postage, or return book postpaid. (We pay postage on orders accompanied by remittance.)

Name .....

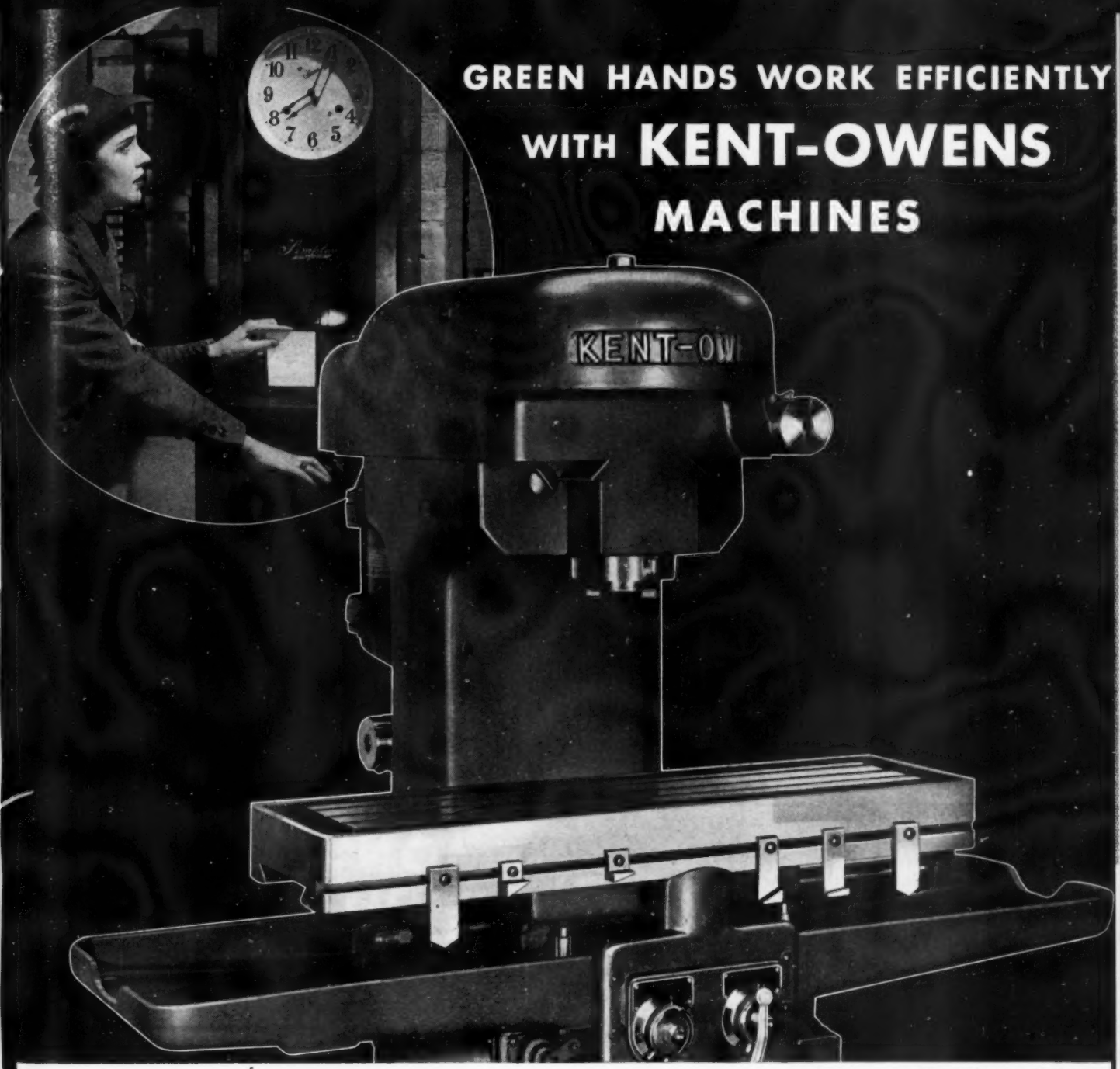
Address .....

City and State .....

Position .....

Company .....A. 2-4-43

GREEN HANDS WORK EFFICIENTLY WITH KENT-OWENS MACHINES



Kent-Owens 1-14V Vertical Milling Machine

THERE'S A KENT-OWENS REPRESENTATIVE NEAR YOU

BOSTON
General Machinery Corp.
BUFFALO
Don W. Patterson
CHICAGO
Neff, Kohlbusch & Bissell
DALLAS
Hamilton-Huster Machinery Co.
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Harron, Rickard, & McCone
MILWAUKEE
Neff, Kohlbusch & Bissell
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John J. Normoyle Co.
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F. F. Barber Machinery Co.
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Oliver H. Van Horn Co., Inc.
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Wilson Brown Company
PHILADELPHIA
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SEATTLE
Star Machinery Company
ST. LOUIS
Blackman & Nuetzel Machinery Company
Clarke Equipment Co.
SYRACUSE
J. F. Owens Machinery Co.
TORONTO
F. F. Barber Machinery Co.
WALKERVILLE
F. F. Barber Machinery Co.

● Get your milling jobs done *right*... with men or WOMEN operators... by depending on Kent-Owens Machines! They're rugged...simple...efficient...designed with practical features that green hands quickly learn to master.

Experienced shop men today more than ever appreciate Kent-Owens advantages that are so important to faster, better production. No matter how tough the job... call on Kent-Owens! Send for latest bulletins. Contact your nearest representative or write us direct.

Kent-Owens Machine Company, Toledo, Ohio.

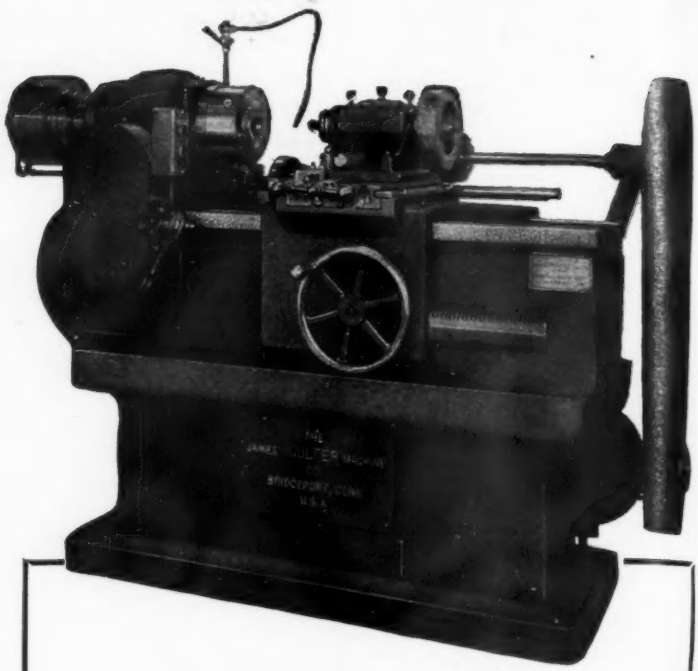
Call on KENT-OWENS *for Milling Machines*

Keep Ahead of
DEFENSE DEMANDS
on the PRODUCTION of
EXTERNAL and INTERNAL
THREADS

The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

Maximum external thread, 7"; minimum hole depends on smallest hob practical.



Send for Descriptive Bulletin giving full information.

The James COULTER *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

SIMMONS 120"x96" HEAVY DUTY PLANER

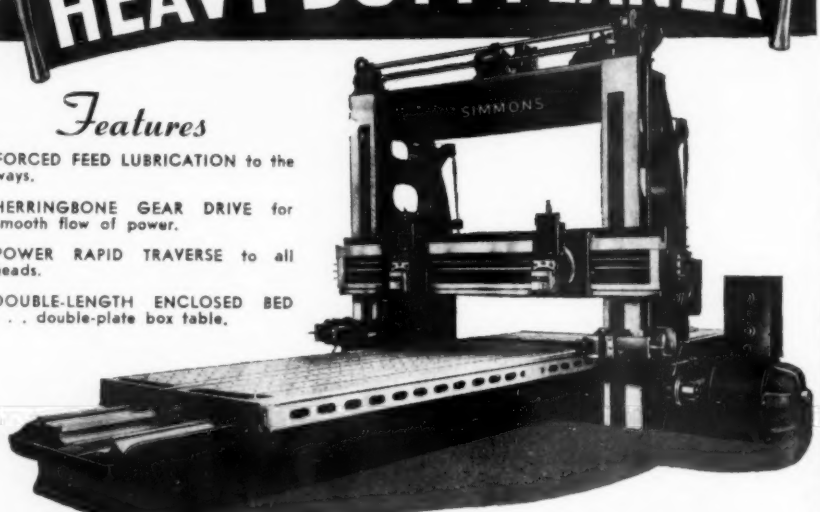
Simmons 120"x96" Heavy Duty Planer is designed for efficiency and economy of operation. Power Rapid Traverse to all heads operates through specially designed clutches. Double length enclosed bed is equipped with forced feed lubrication to the ways. Inner guide box table has one flat and one vee way, riding constantly in a film of oil. Bottom side of table entirely closed. Heavy ribs tie top and bottom securely.

Sykes herringbone gears are used in all drive shafts up to bullgear and pinion which have spur teeth to mesh with table rack.

Electrical equipment includes constant potential reversing motor drive with 50 H.P. D.C. 230-v. 150-900 R.P.M. motor control. Table Speeds 19 to 115 feet per minute. Write TODAY for bulletin giving complete details.

Features

- FORCED FEED LUBRICATION to the ways.
- HERRINGBONE GEAR DRIVE for smooth flow of power.
- POWER RAPID TRAVERSE to all heads.
- DOUBLE-LENGTH ENCLOSED BED . . . double-plate box table.



SIMMONS MACHINE TOOL CORP.
Main Office: 1759 NORTH BROADWAY, ALBANY, N. Y. *New York Office:* 149 BROADWAY

SIMMONS
LATHES • TURRET LATHES • MILLERS • PLANERS • 6" BAR BORING MACHINES

Precision Threads at Production Rates . . .

BY

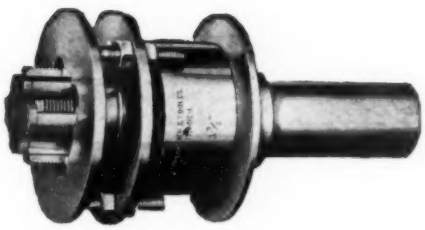
MURCHEY

External or internal threads—right or left hand—in almost any size and to closest tolerances—can be produced on Murchey equipment at a speed to meet your most exacting production demands.

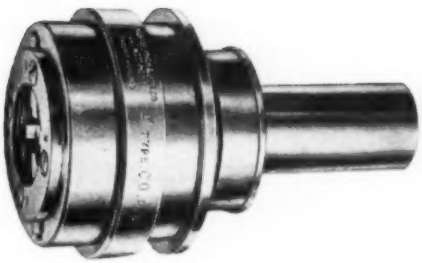
On the new #42 Murchey Thread Milling Machine large diameter threads—from 4" to 12" diameter—can be cut to extremely close tolerances and produced uniformly with absolute concentricity. Precise control of pitch and depth is achieved by the use of annular milling cutters which revolve eccentrically about the work and simultaneously on their own axes until required depth of thread has been produced.

Ask Murchey to help you put your threading on a mass production basis.

We also manufacture all types of Collapsible Taps, Self-Opening Die Heads, Sell Tapping Machines, Bolt and Pipe Threading Machines and Pipe Cutting-Off Machines.



Type "M" Collapsible Tap



Type "CO" Self-Opening Die Head

MURCHEY MACHINE & TOOL CO.

DETROIT, MICHIGAN

Only with the CENTER SCOPE can you get...

And only with the Center Scope is Locating so simple!

Accuracy with the Center Scope is unquestioned at all times—for the optical beam or line of sight is absolutely inflexible and can never be distorted. There is no pressure on the work piece nor is it subject to wear or changes in temperature—for the Center Scope never touches the layout.

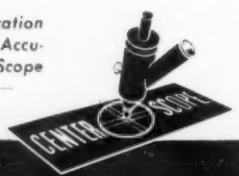
As illustrated, the Center Scope is locating the scribed center line on a die block to the spindle axis of a rotary head milling machine.

In jig boring the Center Scope easily and accurately will locate edges or layouts "within a tenth"—because Center Scope's 45 x magnification allows any operator to see ".0001".

On any machine—the Center Scope is the only instrument that gives you at all times visible assurance of accuracy.

CENTER SCOPE INSTRUMENT CO.
351 South La Brea Avenue • Los Angeles

FREE—new 16 page application booklet "Unquestioned Accuracy." How the Center Scope works, etc.—WRITE NOW—



AN EYE FOR ACCURACY

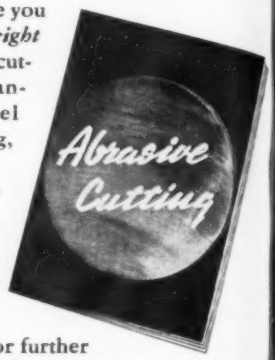
HOW WOULD YOU CUT THIS BAR?

What diameter wheel is best? What wheel thickness is best? How many cuts from one wheel? How fast should you feed?

You will find the answers to those and hundreds of other questions vital to production abrasive cutting in the Andrew C. Campbell Division's

NEW, FREE, ILLUSTRATED BOOKLET

Abrasive Cutting



The 28 pages of this booklet give you data you can use to your profit *right now* if you are doing production cutting of steel, annealed or unannealed, brass, bronze, monel metal, aluminum alloys—tubing, solid bars or flat.

Do you *know* the relative advantages of dry and wet cutting? The proper method of applying coolants? How to control wheel speed and wheel feed to save wheel costs and, on many jobs, eliminate the need for further finishing? Have you convenient data on the type, diameter, thickness and speed of wheel for cutting stock up to 6" in diameter? Those are some of the subjects covered in this free booklet, *"Abrasive Cutting."*

WRITE FOR FREE COPY

If you are doing production cutting, get a copy of this valuable booklet. NO CHARGE. All you need do is write for it on your company's letterhead, requesting that a Campbell engineer call.

Campbell

ABRASIVE CUTTING MACHINES

ANDREW C. CAMPBELL DIVISION
BRIDGEPORT • CONNECTICUT

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

THE HANDS BEHIND THE HANDS BEHIND THE GUN!

In the jungles of the South Pacific—on the hot, blistering sands of the North African desert—wherever our boys are fighting for the right to be free—there, bullets MUST fly straight and true to their marks. Only an accurately formed bullet will follow a true and straight course; an unsymmetrical missile may cost a life!

Manufacturers of every type and size of bullet are using every means at their disposal to assure perfect contours on their products.

VINCO takes particular pride in the knowledge that an ever-increasing number of these manufacturers are depending upon VINCO to provide accurate profile gages for the final inspection of their bullets. VINCO also furnishes master gages for checking these profile gages, so that wear will be detected in time.

VINCO Engineers and Mechanics are ready, willing and well equipped to fulfill your most exacting gage requirements.

VINCO
Precision tools & gages

VINCO CORPORATION
8851 SCHAEFER HIGHWAY
DETROIT, MICHIGAN, U. S. A.

What causes poor threads?

H&G CHECK CHART

A GUIDE TO BETTER SCREW THREADS

Under war conditions, it becomes more and more important that we get the most we can out of the tools and materials that we work with.

Reducing the amount of scrap is the same as increasing the quantity of tools and materials available for war work.

If you are cutting screw threads, you will find the "Check" list shown below, a valuable guide towards better efficiency. If you are having any difficulties, find them in the following list and check the causes mentioned.

SO CALLED TAPER THREADS

Poor alignment.
Poor start.
Drag due to machine conditions.
Bad camming.
Chasers shave*
Loose front plates or
Dirt under front plates.
Dirt in chaser slot of carriers, throwing chasers out of trackage or off on length, causing shaving condition.
Worn locking mechanism.
Bent Die Head shanks.
Die Head needs overhauling.
Chasers or carriers sloppy fit in Die Head.

OFF LEAD

Chasers cut hard, due to improper chamfer relief.
Chasers are forced.
Chasers are held back by drag.
Chasers shave.*

ROUGH THREADS

Material cuts poorly.
Dull chasers.
Poor grinding.
Improper cutting fluid.
Too high speed.

POOR THREADS AT START

Poor grinding.
Hesitating start or
Poor camming
Poor alignment.

THREADS DO NOT FIT GAGES

Threads off lead.
Threads taper.
Poor thread form.
Improper setting of the gage itself or worn gage.

POOR MACHINE CONDITIONS

Non-alignment.
Poor condition of spindle.
Camming action.
Improper camming.
Too much float.
Improper speed.
Improper flow of cutting lubricant.

CHASER BREAKAGE

Chasers hit shoulder.
Worn chasers.
Dull chasers.
Improper grinding.
Back drag in machine.
Chip Shavings in Die Heads.
Chasers or carriers sloppy fit in Die Head.
Poor alignment.
Poor start.
Poor condition of threading spindle.
Improper cutting fluid.
Soft stock builds up false cutting edge.
Too small a die head for job.
Chasers not properly adjusted to size when starting.
Oversize stock, causing chasers to mill too much from O.D. or to start hard.

Look thru past issues of "Die Headlines" where these subjects are dealt with. Write for any copies you may have missed and for any of the instruction books shown on the last page.

*To determine this, stop machine while cutting before die head opens and determine which chaser is shaving. Remove keenness of frosted edges on teeth back of chamfer using a knife edge or very fine hone.

Free—

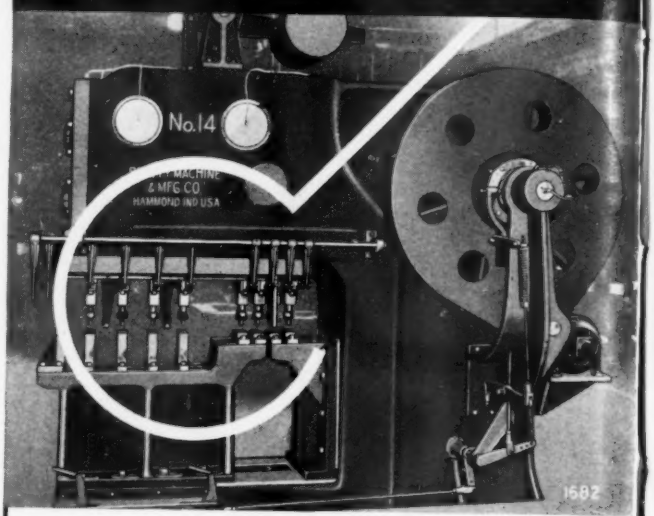
To users of H & G DIE HEADS

THE Check Chart illustrated above will be mailed upon request together with the current copy of "DIE HEADLINES" an informative publication issued from time to time and dealing with practical suggestions for cutting more and better screw threads. This is a part of the service given to users of H & G Die Heads. Please state the makes of screw machines and the style and sizes H & G Die Heads used.

H&G DIE HEADS

The Eastern Machine Screw Corporation
20-40 Barclay Street, New Haven, Conn.

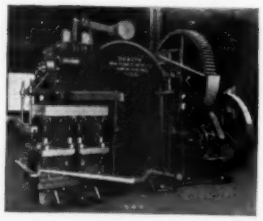
Making Holes "Grow" WHERE "GREW" BEFORE



BEATTY'S TOGGLE BEAM PUNCH SPEEDS PRODUCTION

This BEATTY Toggle Beam Punch provides double gag punching and die holders. Holes of two diameters can be punched on the same pitch line without changing tools. This means faster production, a saving of man-hours and money. Control provides for production or duplicate punching. Gag levers can be operated singly by detaching levers. Write for complete information on this and other units in Beatty's complete line of heavy duty punches, shears, coping machines, forcing presses, extruding presses, hydraulic forming presses and bulldozers.

BEATTY HEAVY DUTY PUNCH



Exceptionally large die space adapts this machine to an extensive range of work. Used with well-planned combination set-ups, it reduces handling costs by completing long sections of work at one pass. Write for more information.

BEATTY MACHINE & MFG. COMPANY HAMMOND, INDIANA

NO LOST TIME IN POSITIONING MATERIAL
NO WAITING FOR PRODUCTION TOOL UP
NO SHEARED PUNCHES AND DIES FROM INACCURATE SET UPS
WIEDEMANN MACHINE COMPANY
TURRET PUNCH PRESSES WITH GAUGE TABLES
THE STORY OF SHORT RUN PIERCING ECONOMY
BULLETIN NO. 92
NO WAITING FOR DIE SET UP MAN
NO SHUT DOWN OF PRESSES
NO RUNNING TO TOOL ROOM OR DIE RACK
NO LAYOUTS
THE METHOD OF SHORT RUN PIERCING
THAT REDUCED 10½ HOURS TO 73 MINUTES!

Bulletin 92 is an analysis of short run piercing operations as applied to the piercing of sheets and plates up to ½" thick, produced on Wiedemann Turret Punch Presses with Gauge Tables.

Bulfetin 92 shows the reasons why it was possible for a large manufacturer to cut production time on a special panel from 10½ hours to 73 minutes with a Wiedemann Turret Punch Press—and how another went into immediate production on a long run chassis contract while waiting for multiple dies to be made. Users report time and labor savings up to 2000% on short run piercing operations.

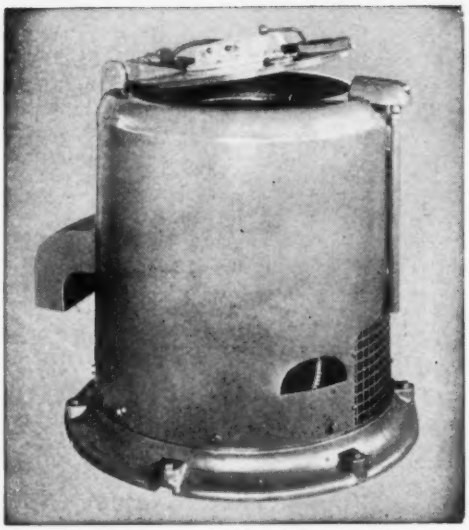
The Wiedemann Turret Punch Press with gauge table assures almost unbelievably low costs on short run piercing work. There is a size for every need — from 8 ton hand operated to 80 ton power driven.

Write today for your copy of Bulletin 92 — the answer to many a production problem.

WIEDEMANN MACHINE COMPANY
1819 SEDGLEY AVENUE, PHILADELPHIA, PA.

WIEDEMANN TURRET PUNCH PRESSES & GAUGE TABLES

DRY SMALL PARTS QUICKLY and ECONOMICALLY with BARRETT CYCLONE CENTRIFUGAL DRYERS



The Barrett Centrifugal Dryer — efficient, self-contained, and compact is built in several sizes.

• The Barrett Parts Drying Process centers around a method of creating a guarded cyclone.

In operation, parts to be dried are placed in a well ventilated motor driven rotating basket. Free liquid is immediately thrown off by centrifugal force and any moisture remaining on parts is absorbed in the shortest possible time by the large volume of expanded air continually forced over and through the contents. Provision is made for heating and expanding, also boosting the flow of incoming air to assure faster absorption of moisture. With the large exhauster provided, heated air is not always required.

Direction of basket rotation can be quickly reversed which will change position of the load and accelerate drying. Baskets are available in shapes which experience has shown to be most effective for handling various classes of work.

It will pay to investigate the advantages offered by Barrett Centrifugal Dryers on your work.

Full Details of the Barrett Cyclone Dryer Sent Promptly on Request

THE LEON J. BARRETT CO., WORCESTER, MASS.

Designers and Builders of Centrifugal Machinery

THE NICHOLS HAND MILLER

» A modern, convenient machine for the volume production of accurate parts . . . .

In the "NICHOLS", the usual features of the hand miller have been combined with a ruggedness of design and construction which makes it a truly production machine tool offering high cutting speeds, maintained precision and long life. A wide variety of operations can be handled at top speed and reduced cost as compared with the same work produced on larger slower machines.

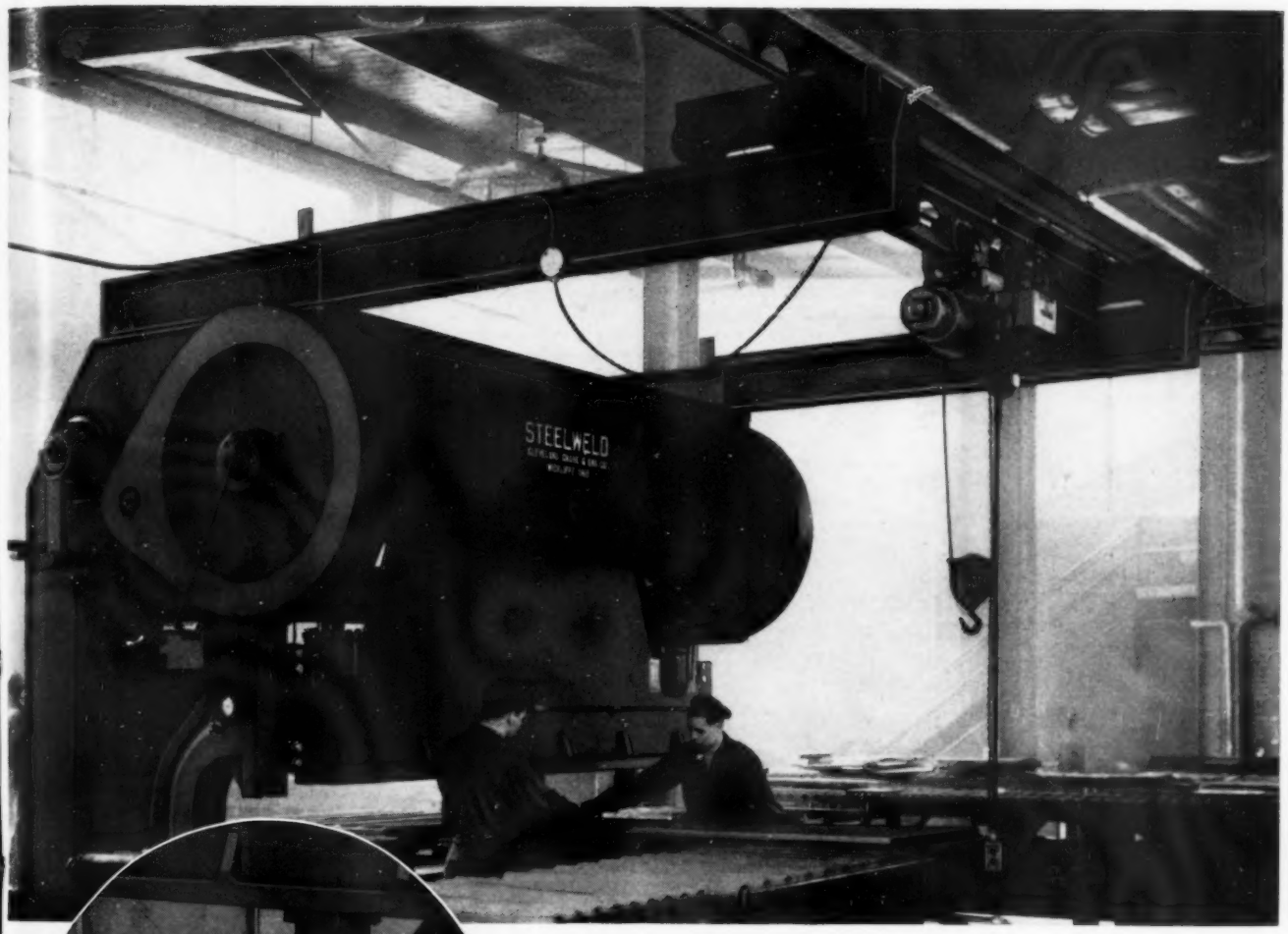
Because of its precision, great versatility and quick set-up, the Nichols Hand Miller is particularly adapted to tool room requirements. Its wide use in this class of service by leading manufacturers is evidence of its recognized value and suitability in meeting the requirements of modern shops.

•

Capacity: Longitudinal Feed, 10"; Transverse Feed, 7"; Vertical Feed of Knee, 13½"; Vertical Movement of Head, 4½", Working Surface of Table, 6½" x 21"; Spindle Speeds, 100, 200, 600 and 1200 R.P.M.

Send for Illustrated Bulletin giving Complete Information

W. H. NICHOLS & SONS *Waltham, Mass., U.S.A.*



A swivel type die is used at Dominion Foundries. The die may be used in the position shown or at right angles. For most plate work deviations are limited to a maximum of 1/16-inch above or below normal.

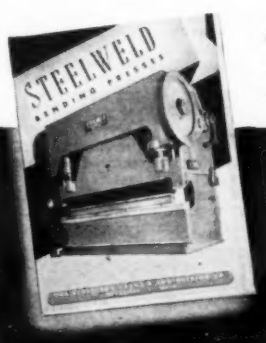
STRAIGHTENING ARMOR PLATE
at Dominion Foundries & Steel, Ltd.

Steelweld Bending Presses of the same type and construction that have been used for bending, forming and punching plate for a multitude of peacetime products are now used in a number of plants for straightening high-tensile heat-treated armor plate in thicknesses up to three inches.

Presses for this work must be extremely rugged and capable of taking a terrific pounding 24 hours a day, week in and week out, with scarcely a let-up. Used like powerful hammers, they shower blows over the hard plates until straight.

The Dominion Foundries & Steel, Ltd., straightens light armor plate with a battery of Steelwelds. Their press men point out several features that they feel are outstanding with Steelwelds which aids them to obtain maximum production. The ram stops quickly with little drift. Exact pressure desired is easily obtained. Clutch and brake are simple to adjust. Very little maintenance is required.

Many Steelwelds are in armor plate-straightening service. Some companies have 10, 20, 40 and more of these machines for this work.



GET THIS BOOK!

CATALOG No. 2002 gives complete construction and engineering details. Mail request for free copy.

STEELWELD MACHINERY DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
EAST 283RD ST. WICKLIFFE, OHIO.

STEELWELD
BENDING PRESSES

GENERAL SALES AGENTS: THE CYRIL BATH CO., E. 70TH & MACHINERY AVE., CLEVELAND

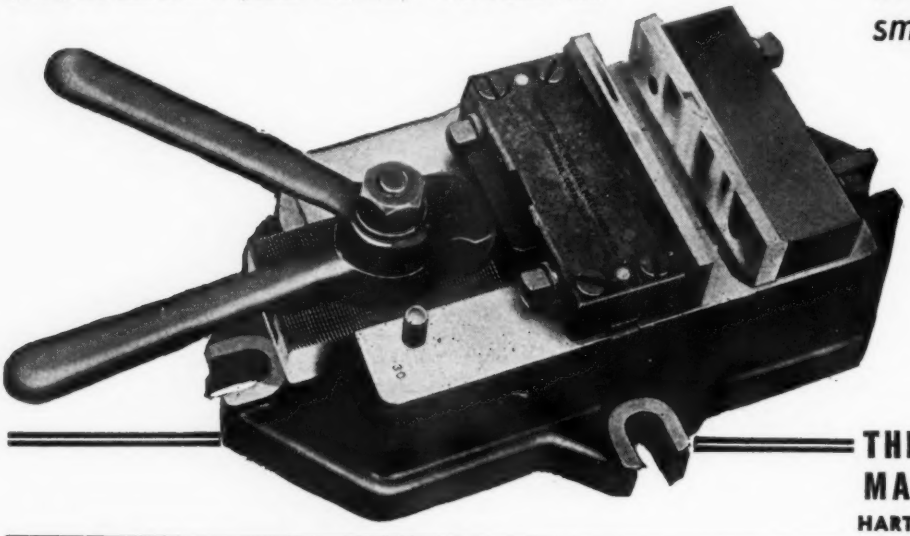
POWER, SPEED, ACCURACY *and* STRENGTH *in the* "HARTFORD" *Quick-Acting* MILLING VISE *make it ideal for small arms production*

All operations on this time-saving, tried and proved vise are handled by the manipulation of two handles. Quick opening and quick return are provided by means of the lower cam faced lever while pressure for holding work is supplied by the top eccentric lever. With a little practice the operator can perform all functions of the "HARTFORD" Vise with one hand.

A convenience feature on thin work is ability to move jaw about ¼" by merely releasing the eccentric binding lever and giving the cam lever a quarter turn. Easy chip clearance and instant release of work are also assured.

Perfect jaw alignment and tremendous strength are assured by "HARTFORD" design which places the movable jaw in the position ordinarily occupied by the solid jaw in conventional screw type vises.

All parts of the "HARTFORD" are made to close tolerances so that replacement parts which are available from stock may be easily fitted. Screw holes in jaws are interchangeable with those of the No. 2 B&S Vise.



SPECIFICATIONS

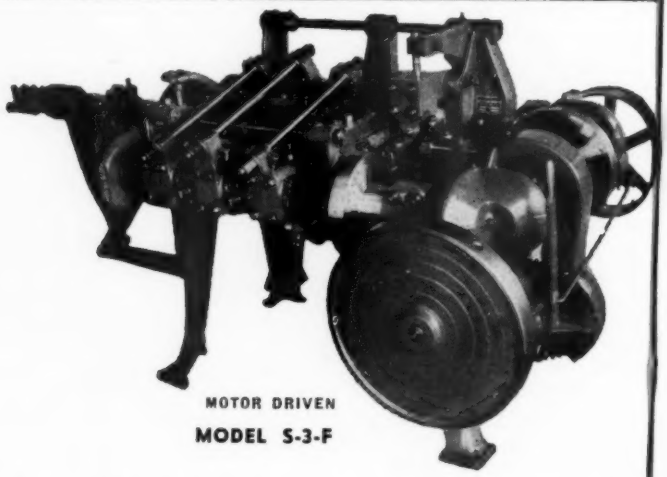
Made in Plain and Swivel Jaw Types
Width of jaw—5"
Depth of jaw—1 3/16"
Max. opening (Plain Jaw) 2⅜"
Max. opening (Swivel Jaw) 2¼"
Weight 40#
Dimensions (overall) 13" long—8" wide—5" high

Investigate Today!

THE HARTFORD SPECIAL MACHINERY COMPANY
HARTFORD CONNECTICUT

STEP UP PRODUCTION OF FORMED PARTS

. . . with the
NILSON AUTOMATIC METAL and WIRE FORMING MACHINES



MOTOR DRIVEN
MODEL S-3-F

Today's requirements for higher efficiency, greater speed and products of greater uniformity and accuracy are met in the new NILSON RIBBON STOCK FORMING MACHINES. These machines are the achievement of over fifty years accumulated experience in designing and building metal forming machines. Careful selection of materials and skilled workmanship result in machines that are famous for long life and low maintenance.

FEATURES THAT CONTRIBUTE TO BETTER, FASTER WORK

Superior features of the NILSON four-slide forming machines are the result of long experience and include:

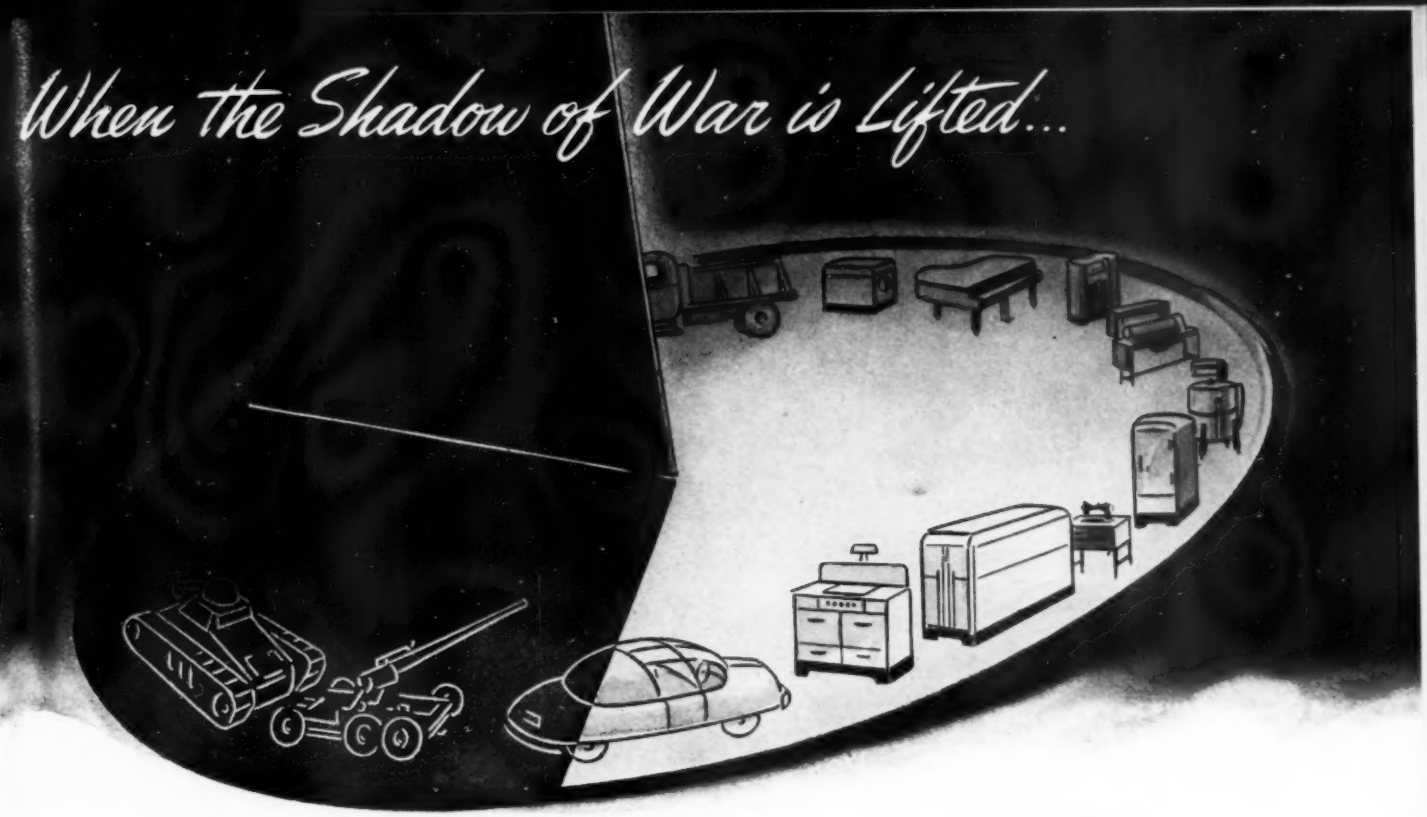
. . . open construction of press and forming tools.
. . . patented slide feed which has an independent cam-operated wire gripping device.
. . . transmission of power operating wire feed through a straight line.

Send for 4-page circular giving further information as well as detailed specifications of sizes and capacities.

• •

We have been engaged in the design and production of special automatic machinery of high production capacity for over thirty years. We are prepared to render a complete service in connection with the design and production of automatic machinery of every description. Consult Nilson on your requirements.

THE A. H. NILSON MACHINE CO. . . . *Bridgeport, Conn., U.S.A.*

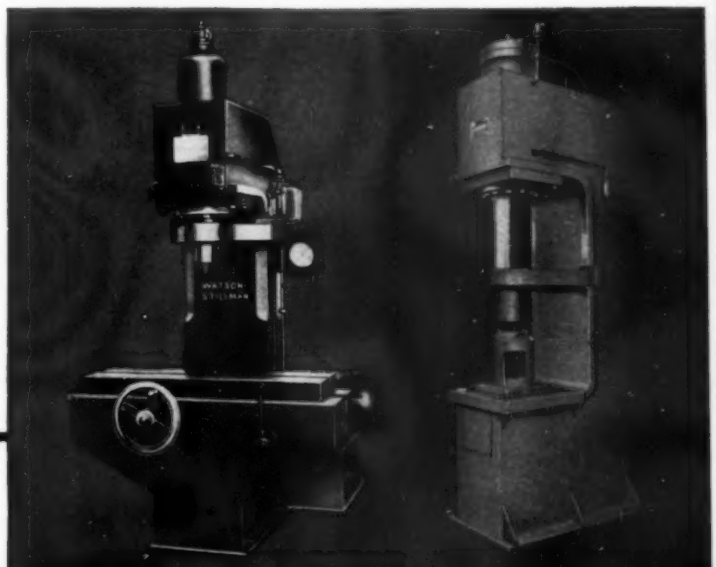


War Busy Presses will do
NEW JOBS HYDRAULICALLY

Some day victory will bring the "cease-firing" order. But it needn't mean "cease-producing" for industries now doing war jobs hydraulically with Watson-Stillman presses. These machines will be adaptable to post-war metal-working operations, and in effecting a rapid, efficient change-over, W-S engineers will be available for special advice.

Their services will put at your disposal hydraulic experience which dates from the eighteen forties. Their suggestions will draw on original research now being carried on. These Watson-Stillman research activities are being expanded in enlarged facilities already under construction.

Watson-Stillman has the modern automatic machinery and the engineering personnel to give practical assistance in planning to meet future requirements. In the post-victory years, the pooled experience of its entire organization can help industry to anticipate its needs correctly. It is not too early now to consult a W-S engineer. The Watson-Stillman Co., Roselle, New Jersey.



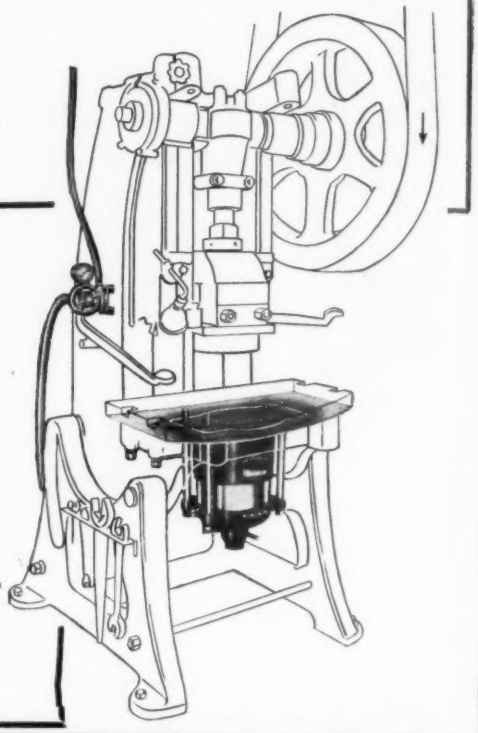
To lift war's shadow more quickly
Buy
U.S. WAR BONDS

WATSON-STILLMAN

Engineers and Manufacturers of Hydraulic Machinery and Equipment—Hydraulic Presses, Pumps and Jacks, Forged Steel Valves and Fittings

RAPID SET-UP *and* MAINTAINED ACCURACY *are assured by the NEW and IMPROVED DAYTON ROGERS Universal Pneumatic* DIE CUSHION

Applicable to all kinds of dies and presses



Easily mounted on bolster plate or press bed frame this modern die cushion which replaces springs or rubbers, provides many advantages depending on the specific application in which it is used. For example:

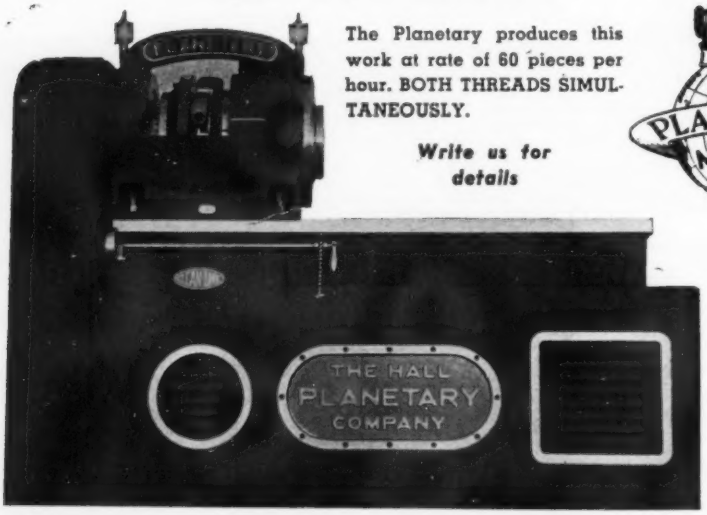
. . . free position of draw ring at correct height is maintained at all times.
. . . makes possible a reduction of first draw to required secondary redrawing.
. . . assures very accurate work.
. . . position of die blanks maintained accurately by pre-determined, automatically retained pressure on die cushion.
. . . permits scrap slugs to fall out while press is in operation.
. . . accurate stripping alignment maintained.
. . . easily controlled and adjusted pressure pad.

Made in sizes from 6" to 16" dia. Send for descriptive bulletin.

DAYTON ROGERS MFG. CO.
MINNEAPOLIS, MINN.

PLANATHREADING

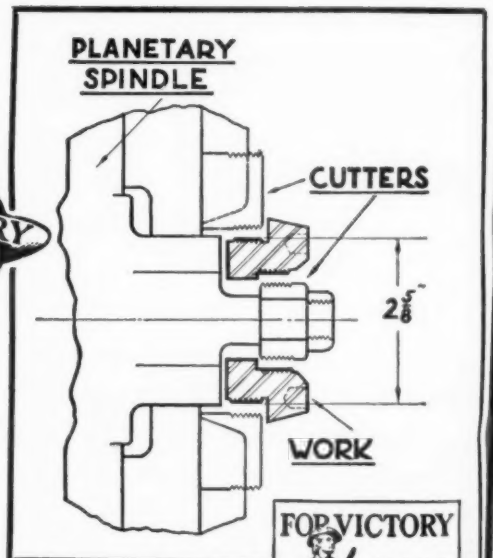
PRODUCTION PRECISION LOW COST



The Planetary produces this work at rate of 60 pieces per hour. BOTH THREADS SIMULTANEOUSLY.

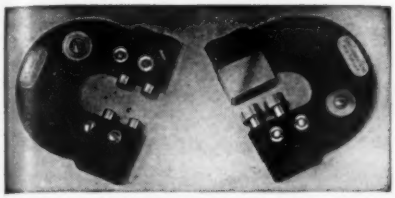
Write us for details

THE HALL PLANETARY MILLER

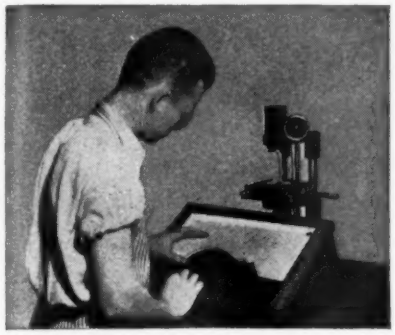


THE HALL PLANETARY CO.
FOX ST. & ABBOTSFORD AVE., PHILADELPHIA, PA.

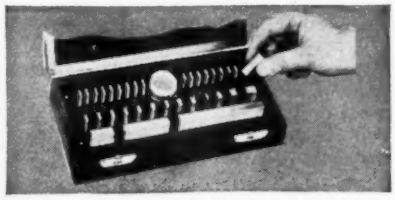
OTHER INSTRUMENTS IN THE SCHERR LIMITED BUDGET INSPECTION LABORATORY



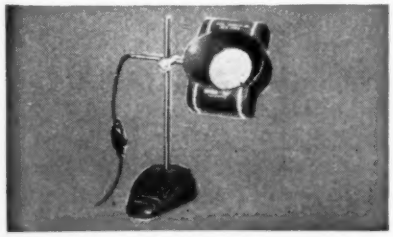
ATLANTIC ADJUSTABLE LIMIT SNAP GAGES provide accurate checkup without having to depend on operator's skill. Sizes to 6".



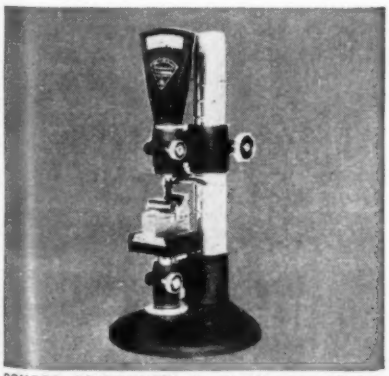
WILDER PROJECTOR provides accurate measuring of comparison of objects by means of magnified shadow. Base price $250.00.



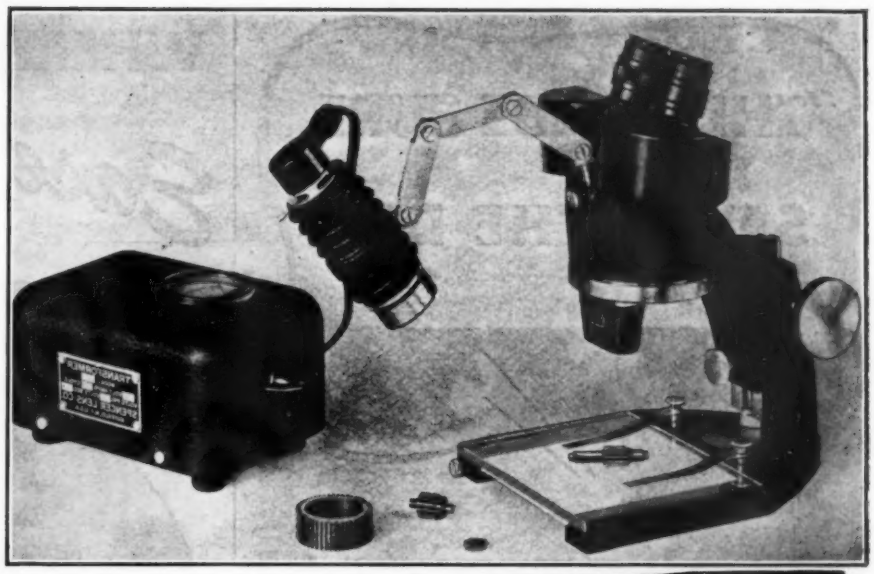
ULTRA-CHEX—a 34-block set accurate to .000008" provides a basic standard of measurements. Price $125.00.



MAGNI-RAY, a wide-field illuminated magnifier providing a means for close inspection of work and operations. Price $18.50.



SCHERR COMPARITOL for checking gage blocks, gages and work for size, accuracy and wear. Price $195.00.



THREE DIMENSIONAL VISION with SPENCER BINOCULAR MICROSCOPE

Simplifies inspection work

This member of the Scherr Limited Budget Inspection Laboratory provides a practical means for applying three dimensional vision to improve the quality and precision of inspection work.

Scratches, surface characteristics and imperfections which are impossible to detect by ordinary microscopes or one-plane vision are clearly revealed when viewed through SPENCER BINOCULARS.

This instrument combines unusual depth of focus, a very wide field and a brilliant resolution of detail to simplify examination and to make its use more effective in exploring materials for surface flaws and irregularities.

Price (without Transformer) $143.50 net fob. N. Y.—including inclined prism body, single adapter with paired objectives and paired eyepieces.

Choice of objectives: 7X, 1X, 2X, 3X, 6X.
Choice of eyepieces: 9X, 12X, 15X, 18X.
Optional equipment: Vertical prism body, triple, revolving adapter, inclination-joint, base with understage mirror, special stands.

Any further information desired will be furnished on request. Send for descriptive literature.

GEORGE SCHERR CO., INC.

124 LAFAYETTE ST., NEW YORK, N. Y.

"THIS BLADE SURE SAVED THE DAY"

"It's mighty lucky that, when other high speed blades became hard to get, we could turn to STAR "Moly"* High Speed—a heavy duty hack saw blade that lasts just as long and saws even faster. Back in 1932, Clemson introduced the first molybdenum alloy blade. Since then, ten years' service in thousands of industrial plants proves that STAR "Moly"* High Speed is unexcelled for fast sawing and long life. From now on, I'll go right on using this better blade with the all-over copper metallic finish."

TWO TIPS FOR TRAINING NEW WORKERS

1 Give them STAR Unbreakable Special Flexible, the all-over green blade that cuts like an "All Hard" yet is so flexible they cannot break it in use in a frame.

2 Give them "Metal Cutting", 20-page STAR booklet of hack saw knowledge. Easy-to-take instruction on selection, use and conservation of blades and frames. It's free.

CLEMSON BROS.
INCORPORATED
MIDDLETOWN, N. Y.

*T.M. Reg.—Blades bearing the name "Moly" are made only by Clemson Bros., Inc. and affiliated companies.

3380

WHERE *Ease of Control* IS A "MUST"

Photo courtesy Bell Aircraft Corporation

"Buffalo" DRILLS

. . . respond efficiently and quickly

Here is *more* than just ordinary drill performance! Buffalo Drills are ideally matched to today's war production needs—especially in those departments depending on women operators. Controls are readily accessible, easy to handle, assuring not only faster, more accurate drilling, but also a minimum of over-fatigue . . . Whether it's rapid production drilling or the precision work of the tool room, there's a Buffalo Drill designed to *deliver the goods.*

BUFFALO FORGE COMPANY
448 Broadway Buffalo, N. Y.
Branch Engineering Offices in Principal Cities
Canadian Blower and Forge Co., Ltd., Kitchener, Ont.

"Buffalo" **DRILLING MACHINES**

SOLVES MANY PROBLEMS

"MORRISFLEX" Machines, in universal use throughout the Aircraft and General Engineering Industry, can be relied upon to give unfailing service, under all conditions. For Grinding, Polishing, Scarfing, Frazing, and *any* special operation allied to the Polishing Industry, they are indispensable. Solid in construction yet easy in operation particularly are they to be recommended in these days when women are replacing men in industry, and the saving of energy is of national and vital importance. The range of "MORRISFLEX" Machines satisfies all demands.

MODEL M102
OVERHEAD
SUSPENSION
TYPE

YOU SAVE TIME, LABO UR and ENERGY WITH

Morrisflex

FLEXIBLE SHAFT EQUIPMENT and REX ROTARY FILES and CUTTERS

"Rex" Rotary Files and Cutters are unrivalled and standard sizes are in constant production. "SPECIAL" are made to order.

Morrisflex Equipment is standardized in the leading Aero and Aero Engine Factories and other important manufacturing concerns of many kinds.

The fact that these goods are advertised does not imply that they are available for export.

B. O. MORRIS LTD. • SHIRLEY, BIRMINGHAM, ENGLAND

PUT YOUR COLD METAL SAWING ON A LOW COST, HIGH PRODUCTION BASIS.. *with this* NEW PORTER-McLEOD MACHINE

Especially designed for stepping-up speed of cutting stock from 3 inches up, the Porter-McLeod 8" Cold Metal Sawing Machine is a money saver that quickly pays for itself.

Driven by a 5 H. P. enclosed motor and conveniently controlled by push button, this new machine makes big savings on general work or on production work involving single or multiple units. Because of its capacity and upper feed it is possible to "nest" economical quantities of bars and shapes so that several pieces can be cut at one time. The standard 3 inch feed of this machine can be increased for cutting brass and non-ferrous metals.

Features which make this machine particularly advantageous for fast accurate production of larger sizes of stock include: support of blade close up to its rim and pulling of blade through the cut, a design which prevents buckling of saw, eliminates weaving, insures maintenance of accuracy and straight cuts; feed is by friction disc which insures against blade breakage especially when hard spots are encountered in the stock being cut.

Get all the details of this new machine by writing *NOW* for descriptive bulletin.

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASS., U. S. A.

MACHINE TOOL COMPANY

Accurate, High-Speed
MOREY VERTICAL SHAPERS

8" STROKE
12" STROKE
14" STROKE

SELF-CONTAINED MOTOR DRIVE

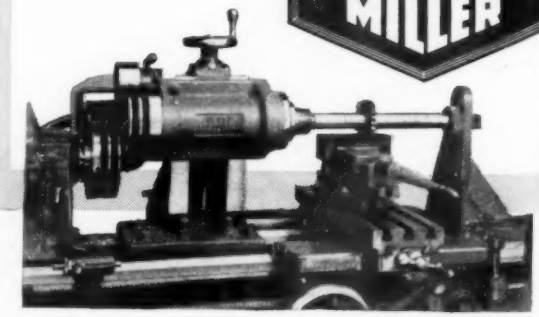
Precision . . . Easily handled — your operators will appreciate it . . . **Cutting Stroke** changed quickly . . . **Feeds** varied instantly . . . **Power** rapid traverse in all directions . . . **Brake** for ram automatically applied . . . **Bijur Lubrication** . . . **Timken Bearings**—Bull gear mounted on Timken Bearings. Roller table mounted on Timken Bearings . . . **Modern Design**—built to the highest standards of workmanship and materials—simplified operation, powerful yet finger-tip control

DESIGNED AND BUILT BY *Ask for Circular No. 726*

MOREY MACHINERY CO., INC.
410 Broome Street New York, N. Y.

Makes a Milling Machine out of your lathe in 3 minutes!

GLOBE MILLER



Quickly attached to your lathe, the Globe Miller, with accessories, does all types of precision milling, yet costs only a fraction as much as a heavy milling machine. Increases lathe swing 5 to 10 inches, depending on lathe size, uses all lathe speeds and feeds. Write today for descriptive folder.

GLOBE PRODUCTS MFG. CO.
3382 Robertson Boulevard Los Angeles, California

How INCO Technical Service helps you conserve critical materials

No matter whether newspaper headlines feature priorities, "PRP", or the Controlled Materials Plan, the need for conservation never lessens. The war must be fought and won. That means critical materials by the carload.

Perhaps you know that every pound of alloy must give maximum service if our far-flung fighting forces are to be supplied and maintained. Nickel, particularly, is needed to give wartime steels greater strength, toughness and resistance to impact.

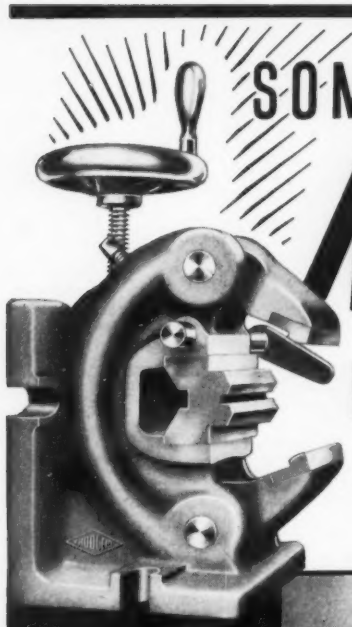
INCO's technical staff is organized to serve users of metals and alloys—to help manufacturers find and adapt alternative materials without sacrificing desirable and essential characteristics in the finished product.

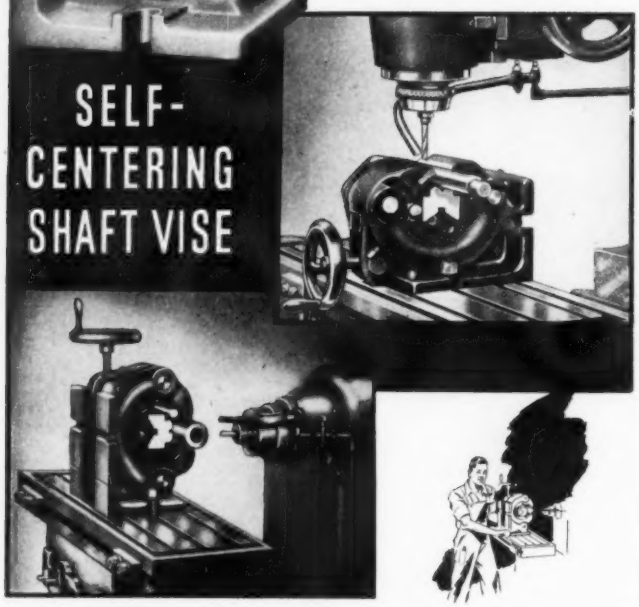
So if you have a problem involving the use of alloys—Nickel or otherwise—please write or wire for data or counsel from our technical staff.

NICKEL

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

SOMETHING NEW HAS BEEN ADDED!





SELF-CENTERING SHAFT VISE

TO THE LINE OF **PRODUCTO MODERN MACHINE VISES**

An entirely new idea in Vise construction in this Country. For machining keyways and slots in shafts or spindles — range of sizes ⅜" to 3⅛" diameter — suitable for vertical or horizontal mounting. Setting of Vise remains unaltered for all work diameters and insures accurate radial cuts. Shafts correctly located in V jaw by equal movement of two jaws. Hardened V jaw reversible in Vise.

Size of Base 8" x 7¼" — Approximate weight 80 lbs.

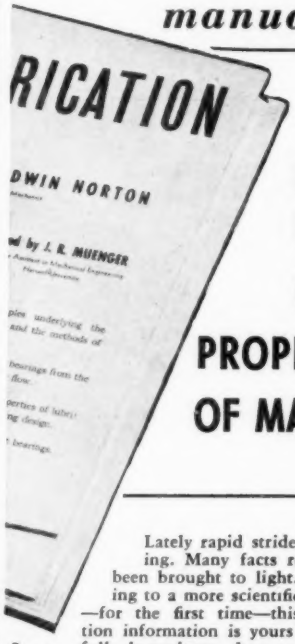
Write for circular

PRODUCTO

The PRODUCTO MACHINE COMPANY

990 HOUSATONIC AVENUE BRIDGEPORT, CONNECTICUT
3017 MEDBURY AVENUE DETROIT, MICHIGAN

AT LAST . . . the lubricating manual of the year!



. . . bringing practicing engineers basic, up-to-date information on PROPER LUBRICATION OF MACHINE BEARINGS

Just Out!

Lately rapid strides have been made in the art of lubricating. Many facts research findings, and developments have been brought to light. Many trails have been blazed, all leading to a more scientific solution of lubrication problems. NOW—for the first time—this great, valuable collection of lubrication information is yours! For in this new manual you are given full, last-minute data covering all the important advances and basic fundamentals in the rational design of machine bearings and in methods of lubricating them.

LUBRICATION

By ARTHUR E. NORTON
Late Gordon McKay Professor of Applied Mechanics, Harvard University

Edited by J. R. MUENGER
Formerly Assistant in Mechanical Engineering, Harvard University

243 pages, 6x9, 115 illustrations. $3.00

This is an authoritative manual that offers practicing engineers and others interested the basic information they need for a thorough understanding of machine bearing lubrication. The book develops the hydrodynamic theory for bearings from the simple concepts of viscosity and laminar flow, and discusses viscosity measurement, the properties of lubricants, and the practical considerations of bearing design. A useful comparison of plain bearings with rolling contact bearings is also made.

The book discusses the types of friction of interest in lubrication and gives criteria for bearings. A chapter is devoted to the properties of lubricants; and viscosity, its measurement and its variation with temperature, is treated at some length. Design practices, including grooving, bearing materials, and methods of applying lubricants are also clearly presented.

Get the facts in these chapters

1. Introduction
2. Fluid Friction and Viscosity
3. Thin-film Friction and Oiliness
4. Properties of Lubricants
5. Hydrodynamic Theory for Slider Bearings without Leakage
6. Slider Bearing with Variable Viscosity
7. Full Journal Bearing without Side Leakage
8. Partial Bearings and Fitted Bearings without Side Leakage
9. Slider Bearings with Side Leakage
10. Journal Bearings with Side Leakage
11. Thermal Equilibrium, Bearing Loads, and Design Practices
12. Grooving, Application of Lubricants, and Materials for Bearing Construction
13. Ball, Roller, and Needle Bearings

10 DAYS' FREE EXAMINATION

McGRAW-HILL BOOK CO., INC., 330 West 42nd Street, New York

Send me Norton—Lubrication for 10 days' examination on approval. In 10 days I will send you $3.00 plus few cents postage or return book postpaid. (Postage paid on cash orders.)

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Address .....
City and State .....
Position .....
Company ..... A. F. 2-4-43

we KNURL 'em

you TWIRL 'em

Sizes from No. 4 to 1½" diameter.

The knurling of Socket Screws originated with "UNBRAKO" years ago.

Quality – PLUS

Knurling is the "PLUS"—the "something added" which you get in "UNBRAKO." It prevents slipping, allows the fingers—handiest of wrenches—to be used to best advantage. Saves precious TIME. Besides these unique knurling advantages, "UNBRAKO" represents the maximum quality attained in a screw—strength, precision. And you pay no more for "UNBRAKO" than ordinary cap screws. Write for Catalog.

UNBRAKO

REG. U. S. PAT. OFF.

SOCKET HEAD CAP SCREWS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA. BOX 4

— BRANCHES —

BOSTON • DETROIT • INDIANAPOLIS • CHICAGO • ST. LOUIS • SAN FRANCISCO

CONTRACT WORK

Advertisements on this and the following page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

METAL STAMPINGS
• TOOLS • DIES •
PERMANENT MAGNETS
HEAT TREATING
THOMAS & SKINNER
STEEL PRODUCTS CO.
1103 E. 23rd St. INDIANAPOLIS, IND.

SUB-CONTRACT FACILITIES FOR
Hand screw machine products
Engine and bench lathe, milling and drill press work.
Small sheet metal fabrications to closer than commercial tolerances.
Stampings.
We do our own tooling
RELIANCE MACHINE & MFG. CO.
Thirty Irving Place New York City
36 years experience in metal fabrication

Gray Iron and Semi Steel Castings, also alloyed with nickel, chrome, and molybdenum. Wood, Iron, Brass and Aluminum pattern work.
KING FOUNDRIES, INC.
Phone 823 North Wales, Montg. Co., Pa.
22 Miles from Philadelphia, Pennsylvania

FORGINGS
• All types up to 6,000 lbs. Smooth Forged—Finished—Rough Turned, Hollow Bored and Heat Treated to Specifications. Crank Shafts—Shafting—Connecting Rods
BAY CITY FORGE CO.
ERIE PENNSYLVANIA

If You Want War Work!

DON'T WAIT FOR IT TO COME TO YOU

The old adage may work for the mouse-trap manufacturer, but to the metal-working shop seeking subcontracts it is an antiquated and dangerous way of thinking. True, the prime contractor may need your help, but today he is busy and cannot search for you. Furthermore, in the tremendous maze that constitutes metal-working America, you may well be overlooked—and better-known if not better-equipped facilities get the business.

BLOW YOUR OWN HORN

Modesty doesn't pay. Remaining unknown won't get you sub-contracts and won't help the Victory program that needs every available plant and tool for war work. Let the men that need your help know about you. In this way you simplify the task of spreading the work and establish a name and leadership for your firm in its field.

WHERE IT WILL BE HEARD—

American Machinist established the CONTRACT WORK SECTION as a meeting place for those needing outside help and those able to give it. That it has served this function is attested to by the volume of requests we receive from subscribers when they cannot find what they want advertised here. American Machinist provides the largest paid audience of your potential customers.

—AND HEEDED!

Many companies desperately want efficient sub-contractors. They are waiting to hear from you and will listen to your message here as they have to others. For example!

"I find it almost impossible to put in writing my thanks for the results of my advertisement in the issues of American Machinist. . ."—Dudley F. Fasoldt.

"Over 40 inquiries and $20,000 worth of business from my advertising in the Contract Work Section . . ."—Bethlehem Mfg. Co.

We will be glad to send you complete details on advertising in the CONTRACT WORK SECTION. A post-card will bring you information on the surprisingly low cost of telling your story to all Metal-Working.

CONTRACT WORK

Advertisements on this and the preceding page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

KIRK & BLUM

CONTRACT MANUFACTURING
ACCURATE SHEET STEEL
STAINLESS STEEL, MONEL OR
OTHER ALLOY FABRICATION
OUR SPECIALTY
CAPACITY 3/8" AND LIGHTER

THE KIRK & BLUM MFG. CO.
2823 SPRING GROVE AVE. CINCINNATI, OHIO

SUB-CONTRACT WORK

WANTED for any
TUBING, BAR or SHAPE PRODUCTS or SHEET METAL PRODUCTS

Such as—
Conduit, Hydraulic and Pneumatic Lines
Shell Bands
Tubular Gun Mounts
Primer Tubes
Retractable Landing Gears

Such as—
Tank Parts—Chests
Work Benches—Tote Boxes
Ammunition Boxes—Shelving
Machine Tool Tenders—Bench Legs
Drawer Cabinets—Ration Boxes

Machine bases, Pedestals, Frames and Lathe Pans formed and arc welded.
Sheet metal fabrication. All kinds of press work. Stampings, Cover plates, Louvre panels.
Light and heavy fabrication and assembly.
Forming, bending, cutting off and machining of bars, tubes and shapes. No item or quantity too large or too small.

Graduate Engineers on Our Staff for Design Work

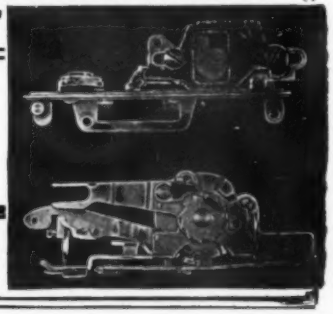
AURORA EQUIPMENT CO. AURORA, ILLINOIS
Phone - AURORA 9232

DESIGN & BUILD
JIGS, FIXTURES & GAGES
REED MACHINE & TOOL ENG.
BOX 662
PAWTUCKET, R. I.

Over 25 Years Experience Designing
JIGS, FIXTURES, DIES, GAUGES
SPECIAL MACHINERY
Prompt Service—Reasonable Rates
D. M. HELLER ENGINEERING COMPANY
134 N. LaSalle St. Chicago

STAMPINGS AND ASSEMBLIES

"GREATER SAVINGS WITH GREIST"



We can make short or long runs in any metal. Our modern equipment and methods, backed by 50 years of experience, are your guarantee of satisfaction. We are also fully equipped to make

SCREW MACHINE PRODUCTS
TOOLS, DIES, JIGS, FIXTURES

Quality work by skilled mechanics is assured. Send your blueprints or samples today!

THE GREIST MFG. CO.
546 BLAKE ST. NEW HAVEN, CONN.

MACHINE SHOP

Facilities include 9" South Bend Bench Lathe, #2 Brown & Sharpe Milling Machine, Drill Press and 8"x8" Shaper. The usual line of hand tools and equipment plus experienced workmenship assure your satisfaction. Your inquiries invited.

C. VANDEGRIFT CO.
HOCKESSIN DELAWARE

CONTRACT WORK—

We can build machines and parts, special tools and fixtures of all kinds to your specifications and design. Skilled workmen and modern equipment are your guarantee of satisfaction. The design and building of wire and ribbon stock forming machines are our specialty.

We solicit your blueprints or samples for quotation. No obligation of course.

THE A. H. NILSON MACHINE COMPANY
Bridgeport, Conn.

CENTERLESS GRINDING
Straight, Cylindrical, Shoulder, Profile, and Multiple Diameters . . . Greased Taper Pins
Screw Machine Products. Heat treated and ground if necessary. Improved and expanded facilities insure prompt and accurate service.
Send blueprints or samples for estimates.
PORTER MACHINE CO.
3139 Eyart Ave., Oakley, Cincinnati, Ohio

COMMERCIAL HEAT TREATING
Seasoning of Steel, Nitriding
Centerless, Broach, Thread Grinding
Magnaflux & Optical Testing
Metallurgical & Chemical Laboratories
Cadmium & Hard Chrome Plating
AGERSTRAND CORPORATION
Muskegon, Michigan

WIRE AND METAL SPECIALTIES
In round, flat, square and special shaped wire in all metals.
LARGE PRODUCTION CAPACITY
Plating and finishing.
EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us—we will take care of them.
GENERAL PATTERN WORKS
2233 Byck Street Cincinnati, Ohio

ADVERTISE HERE
for
PROFITABLE SUB-CONTRACTS
For details, write
CONTRACT WORK DEPT.
American Machinist, 330 W. 42nd St., N.Y.C.

WANTED

High Caliber Sales and Development Engineer

The man we want must be experienced and have a sound knowledge of markets in the grating and welded steel products field. He must know production methods and be familiar with the patents situation. He must be capable of developing markets and be able to design and sell. Please state your qualifications in detail. Here is an unusual present and future opportunity for the right man with a long established, highly rated company.

Write to—

GUY C. CORE CO.

Advertising Agency—Reynolds Bldg.
JACKSON, MICHIGAN

WANTED

HIGH GRADE ELECTRICAL MAN

Must be thoroughly familiar with all types of electric motors, starters, controls, etc. Need not be graduate engineer, but must have proven sales and executive ability. Please give complete details in first letter.

Permanent position at substantial salary to right man. Please do not answer unless you meet fully the requirements outlined.

P-502, American Machinist
520 No. Michigan Ave., Chicago, Ill.

WANTED

Experienced Foreman for a Tool, Cutter and Gage Shop.

P-510, American Machinist
330 West 42nd St., New York, N. Y.

WANTED

HYDRAULIC ENGINEER

with both Aircraft and Commercial experience for Development work. Old established company with excellent post war prospects.

P-355, American Machinist
520 No. Michigan Ave., Chicago, Ill.

EXECUTIVE WANTED

Residing New York City, who held key positions in administration and sales management.

Applicants aged 38 to 50, mail handwritten replies to

P-514, American Machinist
330 W. 42nd St., New York City

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : "OPPORTUNITIES" : EQUIPMENT
BUSINESS : : USED OR RESALE

UNDISPLAYED —RATES— DISPLAYED

10 CENTS A WORD. MINIMUM CHARGE $2.00
Positions Wanted (full or part time salaried employment only), ½ the above rates payable in advance.
Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Individual Spaces with border rules for prominent display of advertisements.
The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

(Copy for new advertisements received by February 8th will appear in February 18th issue subject to space limitations)

POSITIONS VACANT

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

MECHANICAL ENGINEER with extensive gear manufacturing experience for war plant. Wonderful opportunity for well qualified man. Write stating age, draft status, educational background, names and addresses of former employers. P-506, American Machinist, 330 W. 42nd St., New York, N. Y.

WANTED: First class engineer experienced in Machine Tool Design; practical experience desired. For man who can assume responsibility this is a good opportunity now and after war. P-512, American Machinist, 330 W. 42nd St., New York City.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 33 years recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

PLANT MAINTENANCE—Capable planning & supervising work of staff on repair, installation and maintenance work; preparing mechanical & construction plans; estimating and handling volume; originating graph and chart reports. Former general maintenance contractor. Available immediately. PW-513, American Machinist, 330 W. 42nd St., New York City.

EXPERIENCED MAN, 28 years in tool & die making, 17 years in training boys in machine shop practice through the practical application method, desires position as part time assistant with Detroit industrial firm carrying on a training program. Will furnish references. PW-511, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

MANUFACTURING EXECUTIVE—Technically trained mechanical engineer and industrial manager. 22 years experience in manufacturing heavy machinery, precision machine tools, and high quality diesel specialties—8 years in engineering capacities, 12 years in executive capacities. Successful records for organizing and coordinating engineering, manufacturing and accounting functions. Accustomed to complete responsibility. 42 years old. PW-507, American Machinist, 330 W. 42nd St., New York, N. Y.

ENGINEER

will establish your Methods- and Process Department and train the staff recruited from your shopmen for the purpose of making GREEN HELP efficient. Do not answer unless you have a large machine shop and really need more production.

F. J. WINTERSDORFF
99 Crestwood Ave. Buffalo, N. Y.

PROFESSIONAL SERVICES

COLUMBIA ENGINEERING CORP.

STRUCTURAL, MECHANICAL & ELECTRICAL ENGINEERS

War Plant Design - Supervision of Construction - Engineering Reports

61 Broadway, New York, N. Y.
323 Plum Street, Cincinnati, Ohio

SELLING OPPORTUNITIES

OFFERED—WANTED

Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY OFFERED

MECHANICAL ENGINEER for a manufacturer of precision gears. Must have long selling experience in the same line. Write full details outlining educational background, names and addresses of former employers, territory covered. Exceptional opportunity for well qualified man. SW-373, American Machinist, 330 W. 42nd St., New York, N. Y.

REPRESENTATIVE AVAILABLE

MECHANICAL ENGINEER now selling cutting tools in Philadelphia District can represent another manufacturer of tools, machinery or equipment. RA-518, American Machinist, 330 W. 42nd St., New York, N. Y.

(Continued on opposite page)

REPRESENTATIVE

WANTED FOR

Complete line of finest quality diamond dressing tools, as well as highly perfected boring and turning diamond tools.

Exclusive territories available to aggressive Sales Engineering firm understanding the application of diamond tools, and having a concentrated coverage of their individual territories.

Please write giving complete qualifications in first letter.

RW 509, American Machinist
330 West 42nd St., New York City

WANTED

MACHINE TOOL AGENTS

Well established, with concentrated coverage of Ohio, Michigan, upstate New York, and Indiana, for sale of well-known Universal Tool and Cutter Grinder and Plain Miller. Give full particulars and state other lines handled, to

AW-515, American Machinist
330 W. 42nd St., New York, N. Y.

SEARCHLIGHT SECTION

(Continued from opposite page)

PATENT ATTORNEYS

PATENTS, COPYRIGHTS. Booklet. "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 452, 815-15th St., N.W., Washington, D. C.

CONTRACT WORK

WORK WANTED — For advertisements of work wanted see names indexed under Contract Work in the Searchlight Section Index appearing on page Facing inside back cover.

MISCELLANEOUS

WANT A BETTER JOB? On an average Sunday, there are 5,000 jobs of all classifications advertised in the Help Wanted Columns of the New York Herald Tribune. For industrial jobs in defense and other industries—follow the help columns of the Herald Tribune daily and Sunday. M-501.

POST WAR CONTRACTOR WANTED

We wish to contact a forward looking shop owner, now doing war work but with no peace time product, or machine tool builder with facilities expanded beyond peace time demands. The product is a small machine tool for which we have national distribution.

CW-517, American Machinist
520 No. Michigan Ave., Chicago, Ill.

NEW INVENTIONS WANTED

Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

HIGH PRICES

Send us your list of machine tools, electric motors or other idle equipment for prompt action.

GEORGE GALES
1133 Broadway New York City, N. Y.
Tel—CHelsea 3-3600

WANT TO BUY

PLANERS & SHAPERS, LATHES, TURRET LATHES, MFG. MILLING MACHINES, GRINDERS.

Air Compressor Rental Co.
2324 E. 105 St. Cleve. Ohio

WANTED

new or used Hydraulic presses for plastic compression moulding and injection machines for plastic moulding.

W-516, American Machinist
520 No. Michigan Ave., Chicago, Ill.

FOR SALE

One Jones & Lamson, Fay, Single spindle Automatic Lathe; 3 inches through the spindle. Serial No. F15-504. Excellent condition.

EARLE NORTH COMPANY
HOUSTON TEXAS

FOR SALE

2—18" Higley #14 Cut-off Saws
1—2" two spindle, Landis Head, Pipe Threader
1—20" x 40" Newton Facer
1—Heim Centerless Grinder
1—100 lb. Massilon Hammer

COOPER MACHINERY CO.
856 Tod Ave. Youngstown, Ohio

LATHES

No. 324 Adriance Spinning

MILLING MACHINES

2" Pratt & Whitney spline (duplex) (Double)
No. 1 Foote-Burt Surface Broach
New No. 3 Wigglesworth
No. 2 Knight Vertical

TURRET LATHE

Goss & De Leeuw Chucking, 6"x6½"

DRILLS

No. B16 Natco M.D.
3'-9" Canedy-Otto Radial
4 Spindle Taylor & Fenn M.D.

GEAR MACHINERY

6 Cimatool chamfering M.D.
Lees Bradner Gear Grinders (2)
9" Pratt Whitney Gear Grinder
11" Gleason Bevel Gear Generator

MISCELLANEOUS

8" Bullard Multimatic M.D.
No. 1 Foote-Burt Duplex Surface Broach
21'x21"x5' Whitcomb Planer
24x24x8 Whitcomb Planer
36"x36"x8' Woodward & Powell Planer Rev. M.D.
No. 303 Bliss St. Side Gd. M.D.
2" Acme Bolt Threader

WIGGLESWORTH MACHINERY CO.
203 Bent St., Cambridge, Mass.

GRINDERS

Cincinnati No. 5 Plain Miller S.P.D.
Landis 12x36", 16x5, self-Cont., M.D.
Modern 10x24", 14x42", M.D., Norton 16x50"
Pratt & Whitney 14", B.B. M.D.
Norton 50"x28' Roll, M.D.
Heald No. 55, 60.

LARGE LATHES

36"x17' Pond, Grd. Head, M.D.
38"x32' Cleveland Engine, Grd. Head, M.D.
48"x12' Harrington Gap. sld. bed.
26"x13' Boye & Emmes
26"x14' Rahn-Larmon raising blocks to 34"
24"x14' Rahn-Larmon
40"x20' McCabe

AARON MACHINERY CO.
45 CROSBY STREET NEW YORK, N.Y.

500# B&S Board Drop Hammer.
800# B&S Board Drop Hammer.
#14 Cochrane-Bly Vert. Miller & Shaper, M.D.
50" G & E Gear Cutter.
#55 Heald Internal Grinder.
10' Bridgeport Knife Grinder.
30"-24" G & E Shapers.
36" Morton Draw Cut Shaper.
No. 3 Baker Keyseater, 2"x20".

WEST PENN MACHINERY COMPANY
1210 House Bldg. Pittsburgh, Pa.

DIAMOND PRECISION BORING MACHINE

Type A 126 Coulter
Motor Drive-Mechanical Feed

BENNETT & RAFKIN CO.
30 Church St. New York City

PLANERS

24"x24"x6' Flathe, 1 head.
24"x24"x6' Whitcomb, 2 heads.
32x32x10' Pond, 1 head.
35x42x10' Davis, 2 heads.
30"x30"x8' Gray, 1 head.
36"x36"x12' Niles, 1 head.

CANAL MACHINERY COMPANY
176 Lafayette Street New York, N. Y.

ADRIANCE double crank Power Presses equipped with roll feeds suitable for making perforated metal.

TIN CAN MACHINERY of all types including slitters, flangers, beaders, double and lock seamers, strip feed presses, etc.

NATIONAL MACHINERY EXCHANGE
"If it's machinery, We have it"
134-138 Mott St., New York City

POWER PRESSES

BLISS, TOLEDO, V & O, ETC.
REBUILT — GUARANTEED

JOSEPH HYMAN & SONS
Tioga, Livingston and Almond Streets
Philadelphia, Pa.

BORING MILL, 48" Pond Car Wheel
BULLDOZER, No. 8 Ajax, motor-driven
AXLE TURNING MACHINE, Bridgeport Journal, double end
LATHE, 36" Niles, center drive, for truing R.R. wheels mounted on axles
PIPE THREADING MACHINES, 2" Bignell & Keller 6" Oster
SANDSLINGER, Beardsley & Piper "S"
SHOVEL, 6½-yd. Bucyrus-Erie Electric Stripping Shovel, 320-B
UPSETTING & FORGING MACHINES, 2" to 4" cap.
WHEEL PRESS, 275-ton Caldwell, complete with motor, 100" between strain bars.

IRON & STEEL PRODUCTS, INC.
13498 S. Brainard Ave., Chicago, Illinois
38 years' experience
"Anything containing IRON or STEEL"

BOLT AND PIPE THREADERS—1½" & 3" National; 10" & 6" Saunders Pipe.
BORING MILLS—72" Betts, M.D.; and 24" Bullard New Eras, 4" Bar Betts, Knee Type.
CHUCKER—#34 New Britain.
GRINDERS—30" x 240" Landis Cyl. 24" Bridgeport Disc D.C., M.D. 24" x 96" Landis Cyl. 20" x 96" Landis Cyl.; 14" x 96" Cinci. M.D.; 12" x 96" Landis; 12" x 120" Landis; #6 Landis Internal.
GEAR CUTTERS—11" & 6" Gleason Bevel Gear Generators 11" Gleason Bevel Gear Planer (4); 36" G & E Spur and Bevel; 36" Newark Spur, new 1928; 36" x 10" Cinci. spur (2), 60" Gould & Eberhardt spur.
KEYSEATERS—#1 Baker, 12" stroke x 1½" wide. #6 Catlin 40" stroke x 5" wide; #4 Mitts & M.
PLANERS & SHAPERS—38" x 38" x 16' Ingersoll 3 hds.; 36" x 30" x 10' Cleveland openside, 1 rail and 1 side hd., M.D.; 36" x 36" x 10' Flather, 2 hds., M.D., 26" x 8' Gray.
LATHES—9" x 4' Master M.D.; 18" x 6' S. B. & E. 32" x 12' Pittsburgh, Q.C.G. blocks to 44"; 64" x 28' New Haven.
LATHES—16" x 6' Pratt Whitney, 24" x 14' Johnson.
TURRET LATHES—3" x 36" Jones & Lamson. Arranged for bar work, geared head.

ROSENKRANZ MACHINERY CO.
30 Church Street New York, N. Y.

IF YOU ARE DOING DEFENSE WORK

Send for Our Latest Circular Covering Bargains in Small Tools Such as Drills, Reamers, Turret Attachments, etc.

DEWITT TOOL COMPANY
173 Grand St. New York City

No. 2 P & W Shaving Machine
No. 1 Bilton Gear Miller
No. 3 Crescent Saw Table
14"x6' Davis Lathe

D. E. DONY MACHINERY CO.
New and Used Machine Tools
47 Laurelton Road Rochester, N. Y.

BROACH, No. 2 LaPointe, M.D.
GEAR CUTTERS, Spur, 36", 36" & 40" M.D.
GEAR PLANERS, Bevel, 36" & 54" Gleson, M.D.
GRINDER, 18' x 30' x 96' Norton C 1., M.D.
LATHE, Geared Head, 43"x23' N-B-P, M.D.
PRESS, Hydr., 1000 ton Wood, platen 42" x 9'.
SLOTTER, 48" Morton, Portable, M.D.
STRAIGHTENER, 12-roll Kane & Roach, M.D.

LANG MACHINERY COMPANY
28th St. & A.V.R.R. Pittsburgh, Pa.

MICRO-FINISH WITHIN PRECISION LIMITS WITH STANDARD GRAIN WHEELS

assured by

HILL-CLARKE *Modernized Motor Driven* CYLINDRICAL GRINDERS

Refinements incorporated by Hill-Clarke in these machines assure precision, minimum vibration and a finish which requires no extra grinding time. Even when using standard grain free-cutting wheels, these machines can be depended on for super-grinding and micro-finish.

Among the modern features offered in these machines to insure performance which meets today's exacting demands are the following Hill-Clarke developments.

. . . Multiple V-belt drive from constant speed motor to work head.

. . . an accurately fitted wheel slide having a ball bearing mounted feed screw—a refinement which assures sensitive wheel control and makes possible the duplication of work to extremely close limits.

. . . sheaves and motors dynamically balanced to insure smooth, vibrationless performance.

. . . mounting of coolant pump on a separate multiple compartment settling tank as a further means of eliminating vibration.

Other details of design and refinements are fully covered in illustrated bulletin "Super Grinding"—available promptly on request.

SIZES AVAILABLE

10x36
10x50
10x72
14x36
14x50
14x72
14x96
16x50
16x72

●

We can now Modernize and Motor a limited number of your NORTON Grinders.

HILL-CLARKE MACHINERY CO. CHICAGO U.S.A.

HILL-CLARKE MACHINERY CO.

649 WASHINGTON BOULEVARD **CHICAGO, ILL.**

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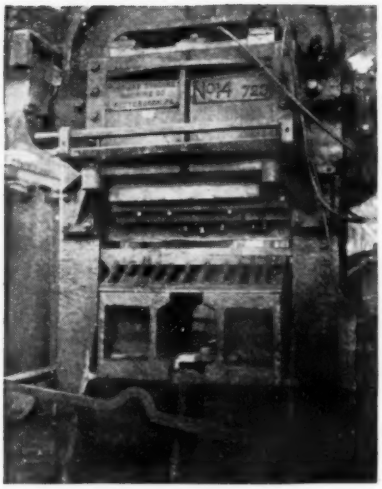
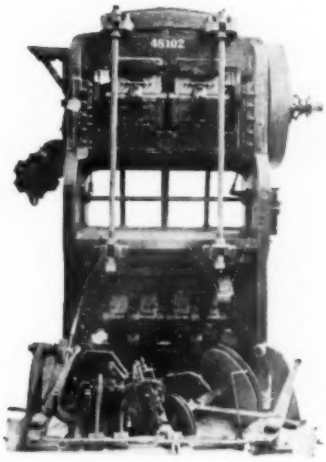
FALK DEPENDABLE MACHINERY

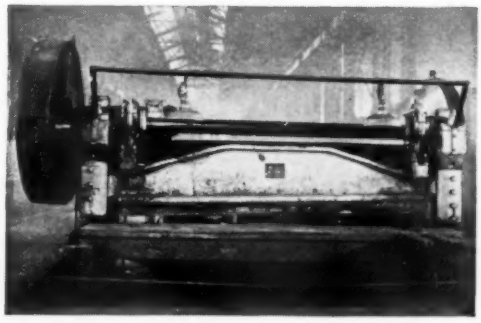
PRESSES AND SHEARS



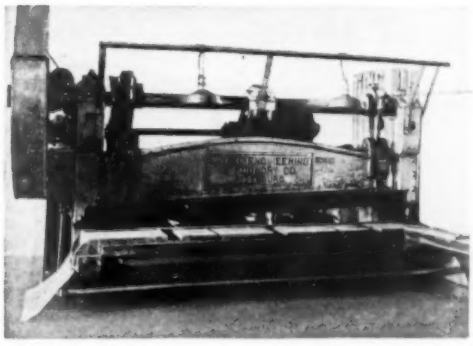
#14 Thomas Spacing Machine
Spacing Table also available
Warehouse Rochester
Prompt Delivery



Bliss 310S Automatic Gang press.
For rapid accurate production from ribbon stock, small sheet steel or sheet brass articles.
Does eight operations at once. Dies operate on independent sub-press. Tie rod frame



Mesta 156"x38" Cap. Plate Shear Motor Drive
Guaranteed excellent condition
Gap Frame.
Can be inspected Warehouse Rochester
Prompt Delivery



United Foundry & Engineering Co.
156"x5/16" Cap Plate Shear
Gap Frame **Motor Drive**
Perfect condition
Warehouse Rochester **Prompt Delivery**

PRESSES

No. 4 **Bliss**, double crank, geared forging press
2—No. 4½ **Bliss**, double crank geared forging press
2—No. 4½ S **Bliss**, three column, geared forging press with Taper rolls
No. 5—**Bliss**, double crank, geared forging press
48" **Wickes Bros.** double end punch and shear 1¼ thru 1¾ cap. motor drive

SHEARS

Niagara No. 2120, 10'x14 gauge cap., motor driven, with back gauges and hold down. Late model, steel cross head.
1¼" thru 1" **Long & Allstatter** Comb. Punch & Shear.
Pexto foot Shears, size 36" x 16 gauge.
156" **Hyde Park**, ⅝ cap. 18" gap, M.D.
156" x ¼" **Hyde Park** Gap Frame Plate Shear M.D.
No. 702—**BLISS** TRIMMING PRESSES (2) Flat.
No. 4—**Waterbury** open back, rigid bed, plain.
520 Ton Southwark Hydraulic with Laurie Pump.
SHERIDAN EMBOSSING PRESS, 24x36.

PRESSES

No. 96C **Toledo**; Twin Geared, Double Geared, Tie Rod Double Crank, Single Acting Power Press, Bed Area 72"x51".
No. 94½J **Toledo** Double Crank, Double Geared Twin Drive, Motor Driven Straight Side, Tie Rod Power Press, Bed Area 120"x50".
Toledo 93½J 125 Ton Power Press, Bed Area 95x34, Single Acting, 6" stroke, Double Geared Tie Rods.

Buy From Stock

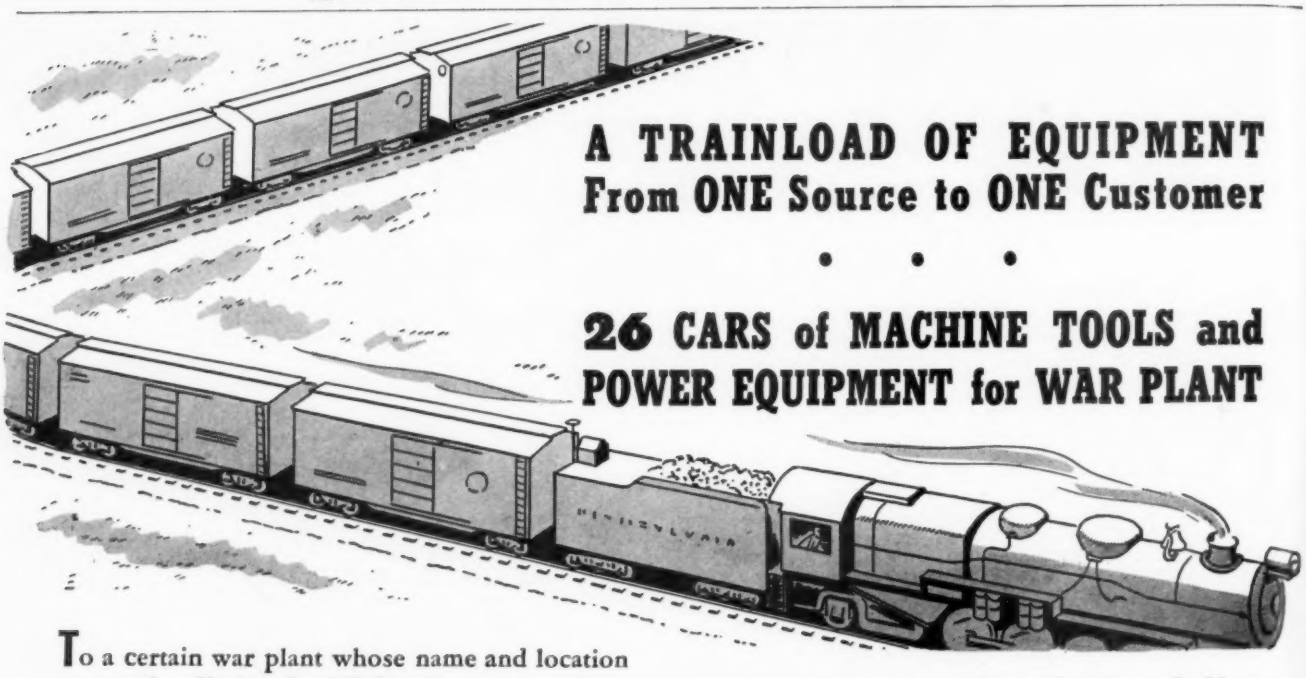
MACHINERY **FALK** **MERCHANTS**

18 WARD ST.

Every Item Guaranteed

MACHINERY CO.,

ROCHESTER, N. Y.



A TRAINLOAD OF EQUIPMENT
From ONE Source to ONE Customer

• • •

26 CARS of MACHINE TOOLS and POWER EQUIPMENT for WAR PLANT

To a certain war plant whose name and location cannot be disclosed, O'Brien last year made a record shipment—26 carloads of machine tools and equipment at one time. Included in this trainload were planers, boring mills, slotters, drill presses, straightening rolls, milling machines, grinders, plate planers, punches, shears, lathes, bolt cutters, screw machines, turret lathes, and all electric motors to special specifications; shafting, hangers, pulleys, belting; boilers, air compressors, pumps—literally everything to put the plant in operation. This buyer not only received at one time equipment almost impossible to pick up from many different sources, but he saved months of precious time.

PLACE YOUR ENTIRE ORDER WITH O'BRIEN

Selection from current offerings—subject to prior sale

DRILLS—5' Bickford Radial, 13" column, mtr. drive.
4 spindle Leland-Gifford B.B. Sensitive, #2 taper, tapping attachment.
16" Henry & Wright, belt drive, Sensitive B.B., #2 M.T.

GRINDERS—#1 Gardner Face Grinder 7½ HP 3 phase motor hydraulic feeds, table 10"x30".
12"x36" Pratt & Whitney Surface Grinder, belt feeds.
#6 Bryant Internal Grinder, 12" swing, belt dr.
Sellers Tool Grinder, 2 motors, for large planer tools.
Springfield Planer Type, Surface, cap. 12"x50".
18" Gorton Disc Grinder, belt drive, two universal tables.

LATHES
36"x8' South Bend Brake Drum Turning Lathe, belt drive.
30"x10' Bradford, belt drive, plain change.
26"-48"x16' McCabe, double spindle, belt drive, 10' centers.
23"-46"x12 Putnam Extension bed Gap Lathe, quick change, belt drive.
20"x10' American, belt drive, quick change.
20"x14' Springfield geared head, motor drive, quick change.
18"x14' Hamilton belt drive, quick change.
18"x12' LeBlond, belt drive, plain change gear.
16"-23"x8' South Bend Gap Lathe, belt drive.
14"x10' Walcott, belt drive, quick change, taper attachment.
12"x5' Hendey, motorized, quick change, taper attachment.

LO-SWING
3½"x60" Fitchburg Lo-Swing, motor drive, 2 carriages.

MILLERS—#2 Brainard Plain, belt drive, table 8"x30".
Hendey "Lincoln" type Production Miller, table 9"x30", belt drive.
#1 U. S. Hand, belt drive, table 5"x20".

PLANERS—24"x24"x6' Putnam, belt drive, 1 head.

SHAPERS—24" Barker, single geared, belt drive.
20" Barker, back geared, belt drive.
21" Smith & Mills, back geared, belt drive.

SLOTTER
10" Buckton, belt drive, 24" table, 23" throat power feeds.

TURRETS—#3A Warner & Swasey, geared head, universal, for chucking.
32" Bogart heavy duty belt drive, 4" spindle, 28" chuck, hexagon turret.
#2 Foster arranged for bar work, 1⅛" cap., belt drive.
#1 Foster arranged for bar work, ¾" cap., belt drive.

We are also representatives in the Phila. area for many of the leading national manufacturers of new machinery

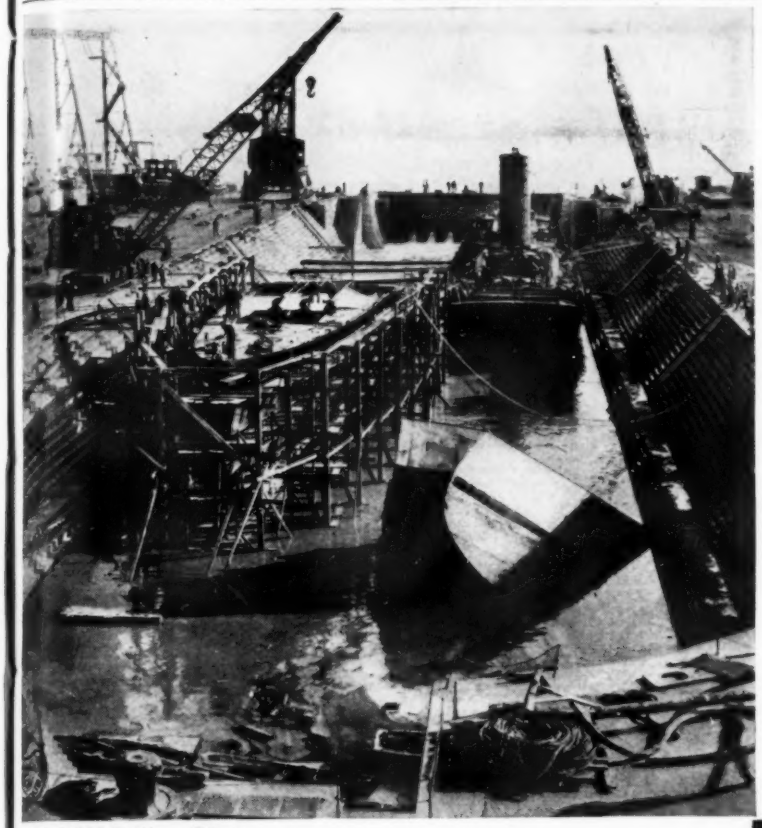
Everything from a Pulley to a Power House

THE O'BRIEN MACHINERY CO.

PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

113 NORTH THIRD STREET • PHILADELPHIA - PENNA.

BELL TELEPHONE: MARKET 4180 CABLE ADDRESS: OBRIEN-PHILA



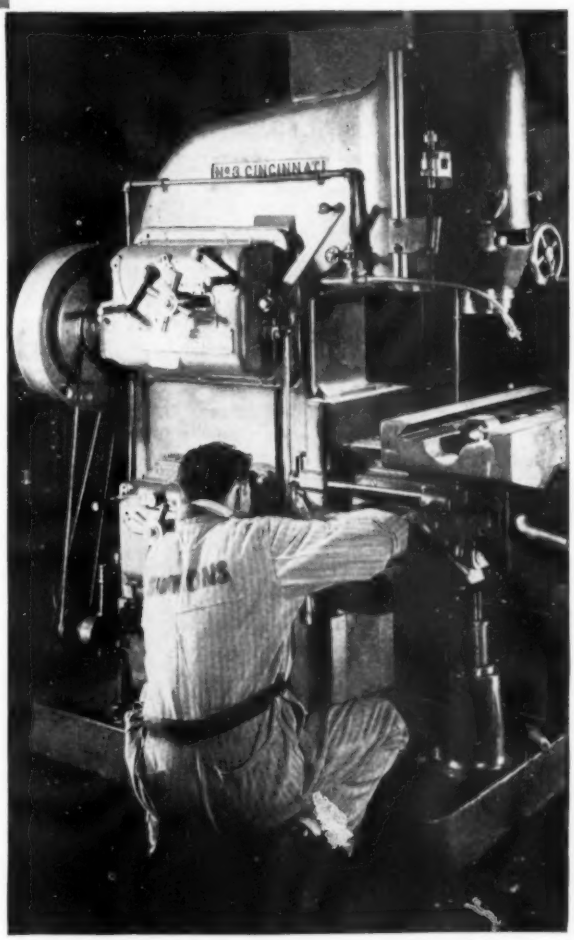
Official U.S. Navy Photo

WAR
hits 'em hard!

★

machine tools, like ships, need time out for repairs

At Pearl Harbor the U.S.S. Shaw suffered a destructive hit on her forward section. Bombs blew off the entire bow of the destroyer. But the determined Navy fitted the battle-scarred ship with a temporary false bow and sailed her across the Pacific to a West Coast Navy Yard, where, as the photograph shows, she was joined to a new bow. "Good as new," the Shaw has long since returned to battle. ★ Battles today start on production lines. Machine tools are weapons of production. This war hits 'em hard! They take more punishment in a single year of intensive, day-and-night shifts than in a decade of normal production. They, too, must be speedily and efficiently rebuilt when they break down. ★ Simmons has restored many hundreds of worn-out, damaged machine tools to perfect working condition. This company has the experience and facilities to solve your rebuilding problem quickly. Ask for full details on "The Simmons Way." Simmons Machine Tool Corporation, 1759 N. Broadway, Albany, N. Y.



SIMMONS *Engineered* MACHINE TOOL REBUILDING

AUTOMATICS

14"x19" Fay
No. 6A Potter & Johnston
Nos. 33, 34 and 454 New Britain
4½" Gridley model H
6"x6¾" Goss & DeLeeuw
1" Cleveland "J" double end
No. 16 Gisholt simplimatics
10" Bullard "Vert-au-Matic"

BROACHES

Nos. 1, 3 and 4 LaPoint screw
No. 3 LaPoint double screw
No. 2 Standard screw press
2 ton American rack vertical

DRILLS

15", 20", 21" Buffalo
20", 22½" and 26" Barnes
21" and 25" Superior
20", No. 210 Barnes heavy
24" Barnes all geared
20" No. 23 Foote Burt
21" Cincinnati manufacturing
Natco multiple Nos. 11, 12, B12, C12, 14 and 32, 8 to 62 spindles
No. 1 Baush multiple
No. 13 Pratt & Whitney multiple
Nos. 15½D and 15½F Foote Burt manufacturing
No. 8H Natco hydraulic horizontal multiple
Barnes vert. mult. hydr.
8 spindle No. 6 Moline Holehog
Nos. 0 and 00 Garvin duplex
4"x10" Sundstrand centerer
4' Hammond radial
Sensitive drills. Almost all makes and sizes

FORGING & STRUCTURAL

1½" Acme upsetters
2½" and 4" Ajax upsetters
2" National upsetter
No. 1A Ajax forging rolls
No. 4 Torrington swager
No. 6HS Langelier swager
60 lb. Bradley helve hammer
150 lb. Nazel air hammer
No. 1 Rock River bulldozer
No. 29 Williams White bulldozer
12", 1½"x1" Cleveland horizontal punch
12", 1¼"x1" Long & Alstatter punch
26", ¾"x¾" Rock River punch

GEAR MACHINERY

Nos. 3 & 12 Barber Colman
No. 18 H Gould & Eberhardt
Nos. 1 & 5A Lees Bradner
26"x48" Brown & Sharpe automatic
30" Flather automatic
36" Gould & Eberhardt automatic
60" Cincinnati automatic
Nos. 6, 61 & 62 Fellows shapers
18" Gleason testers & lappers
15" Gleason spiral gear rougers
Gleason spiral pinion rougher
18" Gleason bevel generator
2 spindle Lipe chamferer
Pratt & Whitney worm grinder
National gear checker

GRINDERS

10x36 x 10x50 Norton
12x36 Landis
12x36 Cincinnati
Capitol internal
Nos. 6 & 15A Bryant internal
12"x36" Diamond surface
20"x50" Safety surface
Nos. 50 & 60 Heald cylinder
18", 24" & 53" Gardner disc
24", No. 84 Gardner opposed disc
17"x36"-48" Norton hydraulic crankshaft
Gisholt tool grinder
24" Ingersoll tub type
36" Ransom elect. snagging
16" Norton snagging
2¼" Wil. & Morman drill
Type 15 Norton lapper
No. 575 Hawes tub polisher
20" & 36 Wet Tool

LATHES, TURRET

28" Steinle, 8" hole
24" Steinle 6¼" hole
22" Steinle, 3-9/16" hole
22" Libby, 4½" hole
2¼x24 & 3"x36" Jones & Lamson
Double spindle Jones & Lamson
14"x6' Lodge & Shipley with turret
No. 2 Acme
No. 2 Southworth
No. 2 Warner & Swasey

LATHES, MFG.

11'x3' South Bend, OCG
13"x20" Seneca Falls "Short Cut"
13"x6' Automatic threading
20"x8'6" Wickes mfg.
Melling camshaft
Melling crankshaft
28"x9' centers Bridgeford axle
3½"36" Lo Swing

MILLS, BORING

3⅞" bar Beeman & Smith horiz.
4-15/16" bar Barrett cylinder boring
36" Niles vert. car wheel borer

MILLING MACHINES

No. 3 Turnmilling for round work
Nos. 1 & 1A Davis & Thompson drum type duplex
48" Oesterlein tilted offset
Nos. 10 & 45 Productomatic
No. 6 Whitney hand
12" Pratt & Whitney automatic
Model AB Becker vertical

PLANERS & SHAPERS

24"x24"x5' Gray
24"x24"x6' Woodward & Powell
29"x29"x6' New Haven
36" Morton draw cut shaper
12" Dill vert. shaper or slotter

PRESSES

No. 5 Bliss Consolidated OBI
No. 5½ Niagara OBI
Nos. P2 & PA3 Ferracute
Nos. 14½ & 41A Toledo horning
Nos. 6 & 6½ Wat. Ferrel gap
No. 76 Toledo gap frame
No. 62 Bliss gap frame
No. 38½ Bliss straight side
No. 53 Toledo straight side
No. 8-7 Zeh & Hahnemann S.S.
No. 7 Rockford straight side
No. 4 Massillion straight side
No. 2 Standard screw type
28", No. 71 Swaine dbl. cr.
No. 6A Bliss cam drawing
No. 180 Toledo toggle drawing
No. 796¼ Toledo double crank toggle drawing, 108" bet. upr.
750 ton Baldwin Southwark triple action hydraulic toggle, 142½" between uprights

RIVETERS

Nos. 3A, 4A, 5½B & 7B High Speed
No. 80 Grant
20 ton Allen pneumatic

SHEET METAL TOOLS

4'x3/16" Cincinnati press brake
12'x10 ga. Ohl press brake
4"x3/16" Bay City band roll
No. 352 Toledo band roll
Nos. 1 & 2M Pettingell hammers
⅜"x3' and 5' Shuster wire straightener & cutter
Sleeper & Hartley casing coiler
No. 5 Sleeper & Hartley spring coiler
No. 3 RH Magee Wirer

SHEARS

No. O-15 Stanley Uni-Shear
No. 225 A Bliss slitter
18" Pels beam
2" Newbold guillotine
1¼" Lewis alligator
2" Hilles & Jones alligator

TAPPERS

⅝" National precision nut
Nos. 1 & 2X Garvin
Natco lead screw, 1 & 2 way
1½" National 6 spindle nut

THREADERS

½"x3" Wat. Farrel thread roller
½" Acme double head
¾" Economy
1½" Geometric
2" Landis double
2" Landis pipe & Nipple
2" Rogaco pipe mach.

MILES MACHINERY COMPANY, Saginaw, Mich.

ONE OF THE MOST COMPLETE STOCKS IN THE EAST

"all offered in accord with OPM prices"

LATHES

SEBASTIAN 12"x8' quick change, Gd. Head
ROCKFORD 16"x6' Lathe
AMERICAN 16"x10' quick change
AMERICAN 22" x 8' quick change
SCHUMACHER and BOYE 24"x12'
DRAPER 27"x16' Geared face plate
NATIONAL 40"x18' Geared face plate

MILLERS

BROWN and SHARPE Hand Millers
KEMPSMITH No. 1 Universal with Divid. Hds.
GARVIN No. 1½ Universal with Divids. Hds., M.D.
PRATT and WHITNEY No. 3 Plain table 9"x40"
PRATT and WHITNEY No. 12 Production Millers
FOX MILLER, power feed.
KNIGHT No. 1 Vertical Miller
INGERSOLL Slab Miller

SCREW MACHINES

GRIDLEY Four Spindle auto ¾" capacity
NATIONAL ACME Four Spindle automatics ¾", and 2¼" capacity
CLEVELAND Single Spindle Automatic ⅝" capacity
JONES and LAMSON 2¼"x36" Turret
REED-PRENTICE 2" Geared Head Turret, with cross-slide feed to turret

BORING MILLS

BINSSE 2½" Bar Horizontal Boring Mill
BULLARD 30" Vertical Boring Mill with hexagon turret.

SHAPERS AND PLANERS

1 SPRINGFIELD 14" Crank Shaper
2 HENDEY 16" Shapers
1 JUENGST 18" Shaper
1 HENDEY Midget Planer 12"x12"x2'
1 POWELL 36"x36"x8' Planer
1 SELLERS 36"x36"x9' Planer, 4 heads

GRINDERS

1 BULLARD 24" Vertical Rotary Surface Grinder similar to Blanchard No. 16
1 BROWN and SHARPE No. 3 Planer Type Surface Grinder with 30" Magnetic Chuck
1 HEALD No. 55 Internal Grinder
1 BROWN and SHARPE No. 12 Plain Cylindrical Grinder
1 LANDIS 20"x96" Universal Cylindrical Grinder

DRILLS

1 HENRY & WRIGHT 4 spindle Hi-speed Drill
1 FOSDICK 2½' Radial Drill
1 DRESES and MUELLER 3½ Radial Drill, M.D.
1 PRENTICE 26" Upright Drill, sliding head
1 PRATT and WHITNEY No. 12 Multiple spindle Drill
1 BAUSCH 12 spindle Multiple Drill to drill 12-1½" holes
1 DETROIT 5 spindle Horizontal Drill

PRESSES

BLISS Nos. 18, 19, 19½, 20, 21, 21½ O.B.I.
CONSOLIDATED 72" Double Crank Power Press, twin drive, power adjustment to ram.
BLISS Nos. 1, 1½, 3 and 4 Toggle Draw
BLISS Nos. 1, 2, 4B Double Crank Presses
BLISS No. 16, 39 Horning Presses
CONSOLIDATED No. 24, and No. 84 Horn Presses
CONSOLIDATED 36" wide Ram Double Crank Horn Press.
WATERBURY FARREL Eyelet Presses.
ADRIANCE No. 406A Arch Geared Press
ADRIANCE Double Crank Perforating Presses with Auto Roll Feeds
NIAGARA No. 86 Double Action O.B.I.
WATERBURY FARREL Dial Feed Cartridge Shell Presses, all long stroke.
WATERBURY FARREL Horizontal Rack and Pinion Shell Reducing Presses
BAIRD No. 3 Tandern Press with Roll Feed

SHEET METAL

BLISS 36"x14 gauge Shears
NIAGARA Circle Shears
YODER C36 Gang Slitter, MD
BLISS 225A Gang Slitters
TOLEDO 52" Gang Slitter
LAMB & NASH 72" Gang Slitter
YODER Twenty Stand Roll Former
KANE & ROACH Seven Stand Roll Former
BLAKE & JOHNSON 12"x12" Rolling Mill
BRODEN 5"x8" Wire Flattening Mills
OHL 10'x10 guage Press Brake
VERDES, KAPPES 66" Press Brakes
DREIS & KRUMP 10'x10 guage Power Box and Pan Brake
PELS, No. 13 Combination Punch and Shear, with Coper, MD
RYERSON-KLING Nos. 3, and 4 All Steel Combination Punch and Shear with Coper, MD
WELDERS—Spot, Butt and Seam
Can making machinery complete equipment for all types of cans

WIRE WORKING

BAIRD, NILSON and MANVILLE Nos. 1, 2, 3 and 4 Four Slide
SLEEPER & HARTLEY Nos. 0, 2, 2½, and 4 Univ. Spring Coiler.
SLEEPER & HARTLEY No. 3 Torsion Spring Winder
SHUSTER, LEWIS and WELLS—Auto, Wire Straightening and Cutting machines, all sizes
WELLS Bed Spring Machinery
WATERBURY FARREL and MANVILLE—Cold Rivet Heading and Thread Rollers
WATERBURY FARRELL Wire Drawing
NATIONAL Bent Tappers and Wire Nail Machines
BARRED Wire Making Machine
TORRINGTON and LANGELIER Wire and Tube Swedgers

REBUILDING SERVICE—Complete facilities for rebuilding and motorizing your old machine tools.

NATIONAL MACHINERY EXCHANGE

134-138 Mott Street — *"IF IT'S MACHINERY, WE HAVE"* — **New York, N. Y.**

USED and REBUILT MACHINERY FOR SALE

LATHES

Porter Cable, M.D.
Hendy—12"x5', M.D.
Hendy—14"x6', M.D.
Hendy—16"x6', M.D.
Lodge & Shipley—14"x8', M.D.
Porter—14"x8', M.D.
Champion—16"x8', M.D. Q.C.
South Bend—16"x10', M.D., Q.C. Taper Attachment CAP.
Sidney—17"x8', M.D. Q.C. D.B.G. Taper Attachment
Schumacker & Boye 26"x12', M.D. L.C. Taper Attachment
American—26"x18', M.D. Q.C. D.B.G.

TURRET LATHES

Gisholt—21"—2" through spindle
Gisholt—5¾" through spindle.

GEAR CUTTERS

26" Brown & Sharpe
G.E. 3x36" Spur
G.E. 36"

AUTOMATICS

1—#53 National Acme
5—#55 National Acmes, M.D.
1—2¼" Gridley Single Spindle
2—Gridleys, Model G, 1¼" Cap. 4 spindle.
1—2¼ Gridley, 4 spindle

MILLERS

1—#3 Garvin Duplex — Table Capacity 12x64
18—#7 Becker Production
1—#2 Cincinnati Plain Miller, with dividing head.
3—#12 B & S.

GRINDERS

Modern—16"x60", M.D.

SHAPERS

1—10" G&E. M.D.
1—24" Rockford M.D.

DRILLS

4' Bickford
Foot Burt Heavy Duty
Sneider—24"
Eberhardt—24", Sliding Head

BORING MILLS

4" Single Pulley Driven—Bickford Horizontal
2" Binsee, Horizontal
40" Bickford, Vertical

GENERAL

American Planer—36"x36"x8'. 2 Heads on Rail, M.D.
George A. Ohl Power Shear—10', 14 Gauge.
#17 Williams & White Heavy Duty Punch, M.D. 36" throat.
10", 12", & 14" Newton Slotters
16" Beasley Ball Bearing Grinder.
3—Form Rolling Machines (5 sets of Form Rollers)
1—Heller Motor Driven Cold Saw with 24" Blades and 1 Machine to grind saws for same.
Thompson Spot Welder—50 KVA Air Operated
Hydraulic Wheel Press with pump. 150 tons.
1—Schatz Angle Shear—4x4x⅝".

COMPLETE PLANT FOR SALE

1—#2 Cincinnati Universal Miller, dividing head, vertical head, etc.
1—#7 Becker Production Miller
1—#1B Universal Turret Lathe, M.D.
1—Pratt & Whitney Universal Turret Lathe, M.D.
1—Pratt & Whitney Turret Lathe, 1½"
1—Foster, ¾", M.D.
1—14x6 South Bend Lathe, taper attachments
1—14x6 South Bend Lathe, taper attachments
1—Sundstrand Lathe, M.D. geared head, taper attachments
1—Seneca Falls Lathe, 10"x4'
1—Planer 24"x24"x6'
1—16" Ohio Shaper
2—20" Drill Presses
6—Bench Drill Presses—mostly new
1—Wells Hack Saw—new, M.D.

A lot of small tools.

This plant is now in operation.

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We will put it to War Work

Phone: WOrth 4-5710

S. & S. MACHINERY CO.

207 Centre Street New York, N. Y.

EASTERN OFFERS FROM STOCK

ENGINE LATHES

36"x16' Springfield
36"x20' Lodge & Shipley Selective Head, m.d.
27"x16' LeBlond
27"x14' Lodge & Shipley
36"x14' Springfield
26"x16' Betts-Bridgeford—taper
24—48"x14' McCabe 2 in 1, m.d.
24"x12' American
24"x10'Greaves-Klusman
22"x18' Niles
22"x16' centers (22' bed) American 100 H.P. Input Super Lathe, with 100 H.P. D.C. motor and 4 additional motors, has p.r.t., chip conveyor, chip breaker, weight 65,000 lbs., very late type
20"x10' Sidney, taper
18"x10' Barker

TURRET LATHES AND SCREW MACHINES

No. 2 Warner & Swasey, hollow hexagon turret lathe
3x36" Jones & Lamson, bar
3x36" Jones & Lamson, chucking
2 spindle 3x36" Jones & Lamson
14" Pratt & Whitney
20"x7' American
Woods Tilted Turret

MANUFACTURING LATHES

30"x9' centers Putnam Axle Lathe, m.d.
No. 2 Niles-Bement-Pond Axle Lathe, m.d.
42x96" No. 5 Niles-Bement-Pond Center Driving Car Wheel Lathe, m.d., brand new
42"x96" No. 5 Niles-Bement-Pond ditto, used
Niles-Bement-Pond Quartering Machine, new
Niles-Bement-Pond Axle Lathe, cone
64"x11' New Haven Pulley Turning Lathe, belt
3x80" Lo Swing Lathe, s.p.d.
3½x36" Lo Swing, s.p.d.
9x12" Sundstrand Mfg.
11"x4' Wells Speed Lathe
14"x6' Champion Mfg.
15"x6' Automatic Threading

UNIVERSAL CYLINDRICAL GRINDERS

No. 3 Brown & Sharpe, m.d.
16"x40" Landis No. 3, m.d.

SAWS

Kleum Tilting Metal Band Saw 6x6"
5" Newton Cold Saw
6" Avey Miband Cut-off Machine
No. 2B, 5, 6 Cochran-Bly Cold Saws
No. 3, 8 Nutter & Barnes Cold Saws
No. 11½, 16 Higley Cold Saws
No. 15 Lea-Simplex Cold Saw
Espen-Lucas Cold Saw

SHAPERS

32" Smith & Mills Triple Geared
32" Morton Railroad Type Draw Cut, m.d.

SHEET METAL MACHINERY

30" Bertsch Bending Rolls, belt
No. 2 Bethlehem Rotary Shear, 32" throat
No. 34 Lennox Rotary Bevel Shear
Niagara Circle Shear, 13" throat
No. 41 Lennox Shear
Southwark Rotary Metal Cutter, 36" throat
Quickwork Circle Shear, 30" throat
No. 3 Gray Sheet Metal Cutter, 36" throat
No. 230 Robin on Power Square Shear, 12 ga.
36" Niagara Power Square Shear, 16 ga.
8' Niagara 18 ga. Foot Power Shear
No. 0 Niagara Power Beader
7' Robinson Cast Iron Hand Brake, 18 ga.
No. 1218 Dreis & Krump Hand Brake, 18 ga.
No. 22 Williams & White Eye Bender, m.d.
McCabe Pneumatic Flanger, ½" cap.
8', 10' Niles-Bement-Pond Flanger, hand
No. 2 Campbell Nibbler, m.d.
No. 10A Quickwork Seamer
Magee Sheet Metal Wiring & Edging Machine, belt

BORING MILLS

96" King, m.d., p.r.t., 1 turret, 1 swivel head
30" Colburn, m.d., 1 turret head
42" Niles-Bement-Pond Car Wheel Borer
48" Niles-Bement-Pond Car Wheel Borer
Sargent Horizontal Floor Type 2¾" bar
4" double bar Barrett, m.d.
8" bar Barrett, m.d., facing attach.

Many other machines in stock.

Let us quote on your requirements.

The
EASTERN
MACHINERY CO.
1004 TENNESSEE AVE.
CINCINNATI, OHIO

. . IN STOCK

AUTOMATICS

¾" Gridley Model F, four spindle
1¼" Gridley Model F, four spindle
1¾" Gridley Model F four spindle
No. 515 National Acme, four spindle
2⅛" Cleveland Model A, single spindle

BROACHES

No. XB10 Oilgear Hydraulic Twin spindle
15 Ton Hercules Vertical

DRILLS

5' Fosdick Radial, m.d.
6' Prentice Radial, s.p.d.
No. 15½ Foote Burt Fixed Center
No. 12 Natco Multiple Spindle
No. 37 Natco Multiple Spindle
No. 1 Bausch, 8 spindle
Pratt & Whitney Gun Barrel, 2 spindle m.d.

GEAR CUTTERS

No. 3 Brown & Sharpe Automatic
No. 6—72" Brown Sharpe Automatic
No. 6 Fellows Gear
96" Gleason Gear Planer
15" Gleason Spiral Bevel Generator
No. 5A Lees-Bradner Gear Generator
No. 10 Lees-Bradner Gear Grinder
30" Rochester Gear Tooth Rounder

GRINDERS

22"x48" Pratt & Whitney Vertical Spindle Surface, Timken Bearing
30" Diamond Face, 84" Table Travel
10" x 20" Landis Cylindrical hydraulic
18x96 Landis Cylindrical
No. 60 Heald Cylinder

LATHES

No. 4 Elgin Precision Bench, c.d.
14"x8' Walcott, c.d.
16"x6' Cisco, q.h.
18"x8' Lodge & Shipley, c.d.
24"x8' Walcott, c.d.
30"x13' American, q.h.

TURRET LATHES

2x24 Jones & Lamson, q.h.
2½"x26" Pratt & Whitney, q.h.
No. 6A Potter & Johnson, q.h.
18" Libby, q.h.

MILLS

No. 1 Kempsmith Universal, c.d.
No. 1404 K&T Duplex Milwaukee Mill, m.d.
No. 31 DeVlieg Super Mill, m.d.
No. 12 Brown & Sharpe Plain, c.d.
2½" Cleveland Horizontal Boring, s.p.d.
4" Bement-Niles Horizontal Boring
42" Niles Vertical Boring
4½"x12" Pratt & Whitney Thread Mill
6"x48" Pratt & Whitney Thread Mill

MISCELLANEOUS

Wicaco Oil Groover
2" Pratt & Whitney Duplex Spline Mill
No. 8 Whitney Comb. Punch & Shear

PLANERS AND SHAPERS

38"x38"x12' Niles Double End Planer, 4 head
16" Gould & Eberhardt Shaper, c.d.

SAWS

6"x6" Peerless Universal Shaping, m.d.
9"x9" Peerless Universal Shaping, m.d.
No. 12 Higley Cold Cut, 16" blade

TAPPERS

½" Rickert Shafer Radial, m.d.

INDIANAPOLIS MACHINERY & SUPPLY CO., INC.
1959-69 South Meridian Street
INDIANAPOLIS, INDIANA
Eastern Branch:
44 WHITEHALL STREET, NEW YORK, N. Y.

OK'd by Botwinik for war production

GRINDERS

1—Norton 10x50 Cylindrical—M.D.
2—Bryant #12 Internal Hole-Factory M.D. 15½" swing. Wheel slide traverse 10½". Max. Grinding length 8".
1—Heald #70 Internal Hole Grinder
1—Cincinnati #1½ Univ. Tool & Cutter Grinder
1—Van Norman #40 External Radius Grinder
1—Gardner #24—53" Disc Horizontal Grinder
1—Fraser #1 8"x20" Universal Grinder
1—Heald #60 Cylindrical Grinder

MILLERS

1—Pratt & Whitney 6 x 48" Thread Milling Machine
2—Pratt & Whitney 5" Geared Auto. Receding type table Millers—M.D.
4—Garvin #13 Indexing Miller with fixtures
1—Becker #1 Vertical Miller with foot treadle and 12" rotary table
1—Pratt & Whitney #2 Lincoln Type. Table 32"x6"
1—Brown & Sharpe #12 Mfg. Miller. Working surface 29x6". Overarm 3⅜"
1—Pratt & Whitney 2" Double Spline Miller
10—Pratt & Whitney 12" Automatic Millers with receding tables

COMPRESSORS

1—Chicago Pneumatic 16x10x12 Type GC-B Compressor
1—Sullivan Horizontal WJ-3, 14x8¾x10

DRILLS

1—Cincinnati Bickford 4' Enclosed Head, 11" column Radial Drill
1—Natco 16-Spdle. Multiple M.D. Drill, #2 taper
1—Hammond 4' Sensitive Radial Drill.
1—Fosdick Machine Tool Co. 5' M.D. Full Univ. Radial Drill

HAMMERS

1—E. W. Bliss 600-lb. Board Drop Hammer
1—Bradley 80-lb. Rubber Cushioned Helve Hammer
1—Bell 600-lb. Steam Hammer and base
1—Chambersburg 1200-lb. Hammer

LATHES

1—LeBlond #16 Heavy Duty Auto. Crankshaft Lathe, Double End Drive, 12" swing, 40" between centers, arr. for M.D.
1—Warner & Swasey #4 Turret Lathe
1—8"x108" Lo-Swing Lathe—2 carriages
1—8"x132" Lo-Swing Lathe—Steel ways—2 carriages
1—Pratt & Whitney 1x10 Auto. Turning Lathe
1—Pratt & Whitney 1x15 Turret-Power Feed to turret
1—Lodge & Shipley 16"x8' QCG Engine Lathe, M.D. Pan bed
1—LeBlond 14"x6' QCG Tool Room Lathe—M.D.
1—Bradford 14"x6' Tool Room QCG M.D. Lathe—Draw bar and collets
1—Reed-Prentice #2 Production—Auto. Swing over bed 10". 30" between centers. Back tool slide
1—Sellers #709 Engine Lathe. Swing 36"x19'
1—Prentice Bros. 14x6 B.D. Engine Lathe
1—Bridgeford 26"x12' Heavy Duty M.D. DBG QCG Engine Lathe
1—New Haven 24—36x15 LCG Lathe, on risers. Hollow spindle.
1—Johnson 30x24 Triple Geared Lathe
1—Niles 22x12 LCG Lathe
1—Pratt & Whitney 14"x6' Semi-QCG Engine Lathe

PLANERS

1—Whitcomb-Blaisdell-Second belt drive—30"x30"x12' Single Head Planer
1—Wheeler 30"x30"x12' Single Head Planer

SHAPERS

1—Bement Niles 17" Single Traveling Head—Length of bed 6'5"
1—Fellows 36" Gear Shaper
1—Gould & Eberhardt 20" Shaper
1—Hendey 20" Shaper

PRESSES

1—E. W. Bliss #5 Punch Press—M.D.
3—General Mfg. Co. #203 20-ton Flexible Power Press, arr. M.D. Oversize table
1—Bliss #3 Back Geared Punch Press
3—Bliss #58 Open Back Single Edge Press
1—Farrel Fdry. #4 O. B. Single Action Press
1—Farrel Fdry. 8 Straight Sided Trimming with side shear—160 ton cap.
1—Farrel Fdry. 1½ Sprue Cutter

UPSETTERS

1—Ajax Upsetting Forging Machine, 4" capacity
1—Acme Upsetting Forging Machine, 4" capacity
1—National Upsetting Machine, 4" capacity

ADDITIONAL ITEMS

1—Pratt & Whitney #3 Cut-Off Machine, 3¾" hole thru spdle.
1—Goss & DeLeeuw 6" 5-Spdle Chuck'g Machine. M. D.
1—Napier Model B 10 x 10 Metal Band Saw
1—Garvin 2X Tapper
2—Bilton #2½ Gear Cutters
3—Bilton #1 Gear Cutter
1—Nilson #4 Four Slide Wire Former
3—Pratt & Whitney #14 2 Spdle Profilers—M. D.
2—Leland-Gifford 2-Spdle Profilers
1—Newark 3 x 36" Gear Cutter incr. to take larger diam.
1—W. W. Sly No. 00 Sand Blast Outfit, 32" diam. x 48" sand tank. Equipped with Norbide Nozzle
1—Pratt & Whitney #3 Die Sinker
1—Niles 12" Vertical Slotter
1—Pratt & Whitney 2-Spdle Gun Barrel Reaming Machine
1—Pratt & Whitney 4" 2-Spdle. Centering Machine
1—Cleveland 2" Model B Double Slide 18" Feed Automatic Screw Machine

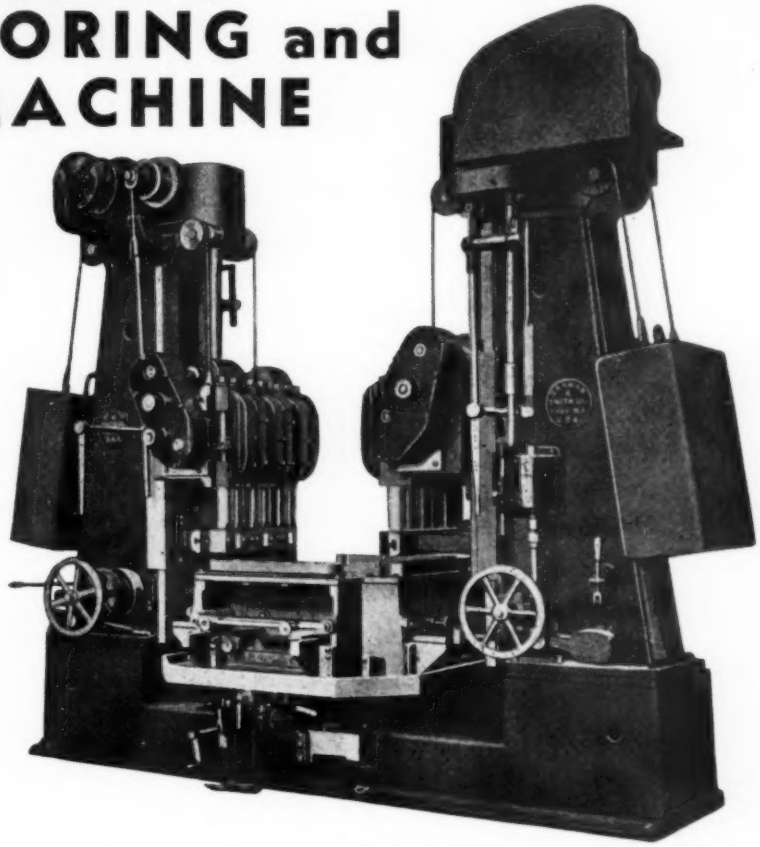
This is a partial list.

Send Us Your Inquiries

Botwinik Brothers of Mass. Inc.
94 COLD STREET WORCESTER, MASS.

AVAILABLE FROM STOCK

DRILLING, BORING and REAMING MACHINE



BEAMAN & SMITH DRILLING BORING and REAMING MACHINE

Equipped with 4 station indexing table.
4 adj. spindles in each head.
Diam. of spindles 4".
Distance between columns 84".

By mounting the proper fixtures on the indexing table, it is possible to rough bore and drill with 1 head and finish bore and ream with the other head. Two pieces can be drilled, bored or reamed simultaneously while two more pieces are being loaded into the fixtures.

Available For Immediate Disposal

LOUIS E. EMERMAN & CO.
Machinery
875 W. 120th St. Chicago, Ill.

NEW MACHINE TOOLS AVAILABLE

The equipment offered below is new equipment packed in the original export crates as shipped by the manufacturers, now in Brooklyn warehouses and offered for cash against warehouse release.

Orders for this equipment must be accompanied with War Production Board release.

1—Peck, Stow & Wilcox Company #142 foot squaring shear standard equipment.

1—Lobdell Car Wheel Co. #1B Nazel Air Hammer #1241 complete with 3 HP motor and starter for 3-50-220 V.

1—Ex-Cello Corp. Cam grinder #24 motor for 3-50-525.

1—Kane & Roach #1A mill, with 15 hp. motor.

1—Eng. & Research Corp. Erco Model #376 Sheet Metal Shrinker with 1 HP 2-speed 3-50-380 V. motor and starter. Also 1 set shrinking jaws.

1—Cincinnati Elec. Tool Co. Type FH—½ HP Pedestal Guide 220 V. DC.

2—Extra 8 x 1" grinding wheels, one fine and one coarse.

1—600 mm. Standard measuring Pratt & Whitney machine with regular equipment metric to operate on 110 volt—50 cycle single-phase current.

1—Cincinnati Elec. Tool Co. Type VA-Y-½ HP internal grinder 380-50-3 phase arranged to carry 2½" dia. wheel.

1—Peck, Stow & Wilcox Co. over-driven power squaring shear. G162—Gap 18'—2N—3-50-380 V.

1—Canedy-Otto Mfg. Co. #16 Royal Bench Drill No. 2, Morse 1/3 HP Kingston Conley BB Motor 1425 rpm, 220 V. 50 cycles 3-phase.

1—Manville No. 188-C High Speed Double Stroke Solid-Die Header (voltage 380 V.).

1—Bliss #1 straight sided single crank, double action toggle drawing press. 5H—3-50-380 V.

10 Rockefeller Plaza **LINDETEVES, Inc.** New York City

Telephone CIrcle 5-6828

GUARANTEED USED MACHINE TOOLS

DRILLS

1 spdl. Leland-Gifford
2 spdl. Leland-Gifford Bench
4 spdl. Sigourney (4)
4 spdl. Woodward & Rogers
4 spdl. Henry & Wright (19)

GEAR CUTTERS

No. 60BM Gould & Eberhardt Bevel Gear Rougher (2)

GRINDERS

(See page 220, Hill-Clarke Cylindrical grinders)

No. 40 Bryant Plunge Cut, Wide Wheel, Oscillating

No. 10 Lees-Bradner Spur Gear Grinder 1½" dia. New Yankee Drill Grinder

TURRET LATHES

18" Libby

HILL-CLARKE MACHINERY CO.
649 Washington Boulevard
Chicago, Illinois

OTT MACHINERY SPECIALS

AUTOMATICS, Gridley, 2¼, 3¼ & 4¼" S.S.
AUTOMATICS, Cleveland, 1¼, 2 & 2½" Model B
AUTOMATICS, Cleveland, ⅞ & 2⅝" Model M
AUTOMATICS, #22, 23 & 24 New Britain
AUTOMATICS, Cone 2⅝" 4 spdle. M.D.
GRINDERS, Norton, 10 & 14x36" Plain

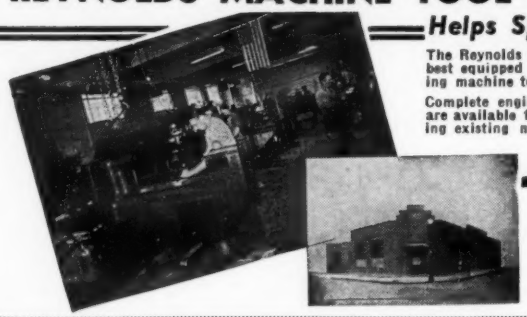
60" x 17' Putnam Lathe with 12" Riser Blocks, total swing 85" M.D.

LATHE, 3x36" J.&L. Dble. Spdle.
MILLING MACHINES, Craftsman #1 & 2
PLANER, Gray, 42"x42"x12', 3 Heads, M.D.
PLANERS, Bedford & Patch, 36" x 13' Open Side with 1 Rail & 1 Side Head
PRESSES, Toledo, #34 Solid Back, S.G.
PRESSES, Toledo, #2 to 5 Open Back Inclinable
PRESSES, Ferracute, P2, 3 & 4, Solid Back

OTT MACHINERY SALES, INC.
542 Second Ave. Detroit, Mich.

REYNOLDS MACHINE TOOL REBUILDING...

Helps Speed War Production



The Reynolds plant is one of the most modern and best equipped plants in Rhode Island for rebuilding machine tools.

Complete engineering and manufacturing facilities are available for modernizing, motorizing and placing existing machine tools in condition for maximum production demands and highest accuracy.

REYNOLDS MACH'Y CO.
211 Eddy St.
PROVIDENCE, R. I.
Phone: Gaspee 5187

VERTICAL BORING MILL

10-ft. Niles; 2 heads; M.D.

DRILLS

3-ft. American Sensitive Radial.
2-spdl. Henry & Wright; 12" overhang; M.D.
10-spdl. Baush Multiple; #3 Morse taper; M.D.
6-spindle Natl. Acme Horizontal.
36" Saunders Sliding Head Upright.

GEAR MACHINERY

60"x12" G. & Eberhardt; M.D.
#6 Fellows Gear Shaper.

FROG AND SWITCH PLANER

36"x14"x20' Putnam; Reversing; M.D.

MISCELLANEOUS

GRINDER, #6 Landis Internal; M.D.
KEYSEATER, #3 Mitts & Merrill.
LATHE Turret, 21" Gisholt; 3½" spindle; M.D.
MILLER Rotary, #3 Davis Thompson; M.D.
PIPE MACHINES, 10" Saunders—Also 2" Jarecki.
RIVETER Hydraulic, 150-ton Chambersburg; 6" stroke; depth of gap 150".
SHEAR Rotary Bevel, #2 Lennox.

SUN MACHINERY COMPANY

36 Van Vechten St. Newark, N. J.

UNUSUAL VALUES

#1 La Pointe Broaching Machine.
3½"x50" Fitchburg Lo-Swing Lathe.
Turret, Lodge & Davis, Brass cross slide turret.
Brake: Robinson toggle 5'
Drill Presses: 28", 24" Hoefer; 25", 20", 40" Bement.
Ceiling Suspended Drill Unlimited drilling area.
Grinders: #20 Bryant Internal.
60" Plate Grinders.
#60 Heald cylinder grinders.
Sellers Tool Grinder.
...machinery items.
Rock River ⅞" capacity punch and shear.
1—3 spindle 1" capacity Bolt Cutter.
1—2 spindle #0 Webster & Parks Threader.
...ic Cutter 1¾ Acme with Landis Head.
Vacuum Cleaner, Invincible, shop use.
2½" capacity Punch and Shears.
MOTORS—New ½ to 30 H.P., 3 phase Ball brg.
Also rebuilt motors.

THE OSBORNE & SEXTON MACHINERY CO.
COLUMBUS, OHIO

BORING MILLS

Colburn 54", 2 heads.
Niles 53", 2 heads.
Bullard 36", 2 hds.

AUTO. SCREW MACHINES

1⅜", 1¾", 2¼" Gridley 4 spindle
1", 2¼" Nat.-Acme 4 spindle
3¼", 4¼" Gridley sgle. spindle

CANAL MACHINERY COMPANY
176 LAFAYETTE STREET, NEW YORK, N.Y.

MISCELLANEOUS MACHINES

Rockford Sgl. End Hydr. Boring Machine with 2-sta., 54" dia. table
6' Niles Pl. Radial Drill
3' Carlton Sensitive Radial, tapping attach.
4-spdl Henry & Wright H.S. Drill
Gisholt Cutter Grinder, arr. M.D.
10x10" Napier Metal Band Saw
½" Shuster Auto. Cut. & Straight. Machine

STRONG, CARLISLE & HAMMOND COMPANY
1392 West 3d St. Cleveland, Ohio
2832 E. Grand Blvd. Detroit, Mich.

IMMEDIATE DELIVERY

10 ft. Pond Vertical Boring Mill

HEAVY DUTY

With 2 swivel heads; diameter of table 96"; maximum distance table to rail 60"; belt drive.

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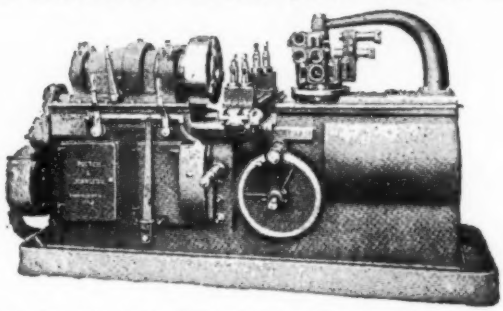

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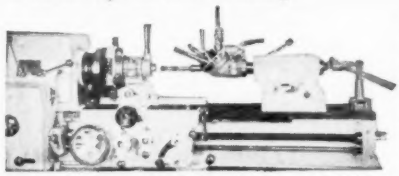

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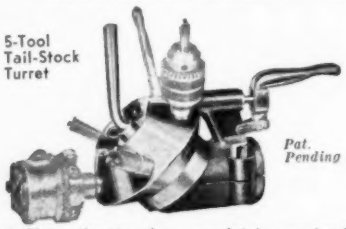

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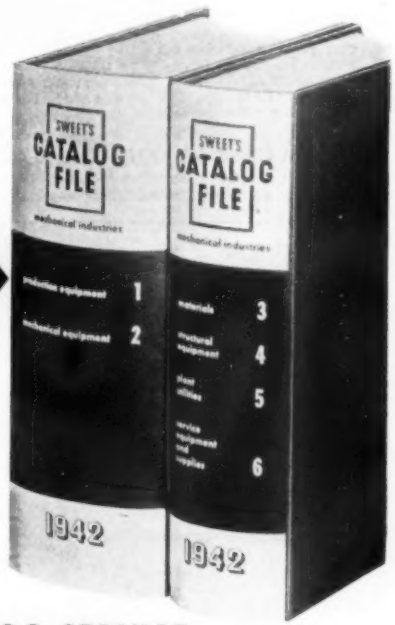

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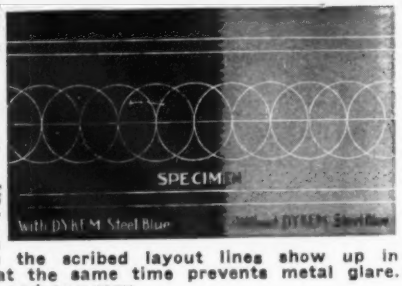

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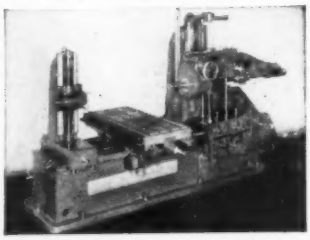

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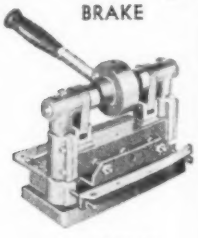

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Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Union Twist Drill Co., Athol, Mass.
Vanadium Alloys Steel Co., Pittsburgh
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H., Buffalo, N. Y.

BLADES, Circular-Saw (See SAW BLADES, Circular)

BLADES, Cutter, Milling, Boring & Reaming (See BITS, Tool)

BLADES, Hack- & Band-Saw
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C. Indianapolis
Capewell Mfg. Co., Hartford, Conn.
Clemson Bros., Inc., Middletown, N. Y.
Continental Machines, Inc., Minneapolis
Disston & Sons, Inc., Henry, Philadelphia
Racine Tool & Mach. Co., Racine, Wis.
Starrett Co., L. S., Athol, Mass.
Thompson & Sons Co., Henry G., New Haven, Conn.
Victor Saw Works, Middletown, N. Y.

BLOCKS, Pillow
Allis-Chalmers Mfg. Co., Milwaukee
Dodge Mfg. Corp., Mishawaka, Ind.
Earle Gear & Mach. Co., Philadelphia
Fafnir Bearing Co., New Britain, Conn.
Farrel-Birmingham Co., Ansonia, Conn.
Hill Acme Co., Cleveland
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S. K. F. Industries, Inc., Philadelphia
Standard Pressed Steel Co., Jenkintown, Pa.

BLOCKS, Precision Gage
Atometric Precision Gage Laboratories, Inc., Stamford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., Dearborn, Mich.
Jansson Gage Co., Detroit
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., Watertown, Mass.
Webber Gage Co., Cleveland

BLOCKS, "V"
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

BLOWERS
Allis-Chalmers Mfg. Co., Milwaukee
American Gas Furn. Co., Elizabeth, N. J
Buffalo Forge Co., Buffalo, N. Y.
General Electric Co., Schenectady, N. Y.
Strong, Carlisle & Hammond Co., Cleveland
Wagner Electric Corp., St. Louis

BLOWERS, Electric Hand
Buffalo Forge Co., Buffalo, N. Y.
Skilsaw, Inc., Chicago

BLUEPRINT MACHINERY & ACCESSORIES
Wickes Brothers, Saginaw, Mich.

BLUING, Layout
Dayton Rogers Mfg. Co., Minneapolis
Dykem Co., St. Louis

BOLT & NUT MACHINES
Cleveland Automatic Mach Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt
Consolidated Machine Tool Corp., Rochester, N. Y.
Eastern Machine Screw Corp., New Haven, Conn.
Federal Press Co., Elkhart, Ind.
Foote-Burt Co., Cleveland
Geometric Tool Co., New Haven, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield Mass.
Haskins Co., R. G., Chicago
Hendey Machine Co., Torrington, Conn.
Hill Acme Co., Cleveland
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
New Britain-Gridley Machine Div., New Britain, Conn.
Oster Mfg. Co., Cleveland
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Scherr Co., Geo., N. Y. C.
Taft-Peirce Mfg. Co., Woonsocket, R. I
W. & O. Press Co., Hudson, N. Y.

BOLTS, Eye & T-Slot
American Chain & Cable Co., Bridgeport, Conn.
Armstrong Bros. Tool Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Cleveland

BOLTS & NUTS
Bethlehem Steel Co., Bethlehem, Pa.
Elastic Stop Nut Corp., Union, N. J.
Parker-Kalon Corp., N. Y. C.
Republic Steel Corp., Cleveland
Rhode Island Tool Co., Providence, R. I
Standard Pressed Steel Co., Jenkintown Pa.

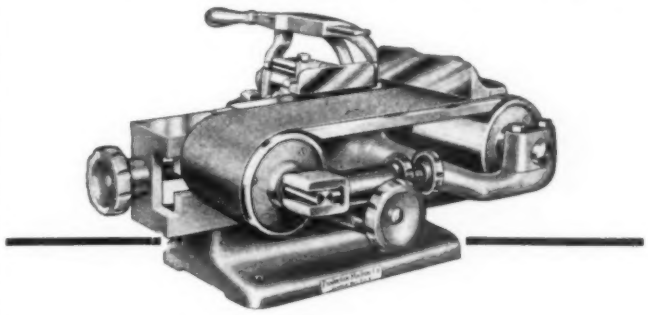
BORING, DRILLING & MILLING MACHINES, Horizontal
Atlantic Machinery Co., N. Y. C.
Avey Drilling Mach. Co., Cincinnati
Barnes Co., W. F. & John, Rockford, Ill
Baush Mach. Tool Co., Springfield, Mass
Bryant Machinery & Engrg. Co., Chicago
Buhr Mach. Tool Co., Ann Arbor, Mich
Cincinnati Gilbert Mach. Tool Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester N. Y.
Defiance Mach. Wks., Inc., Defiance Ohio
DeVlieg Machine Co., Ferndale, Mich.
Foote-Burt Co., Cleveland
General Machy. Corp., Hamilton, O.
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Greenlee Bros. & Co., Rockford, Ill.
Lucas Machine Tool Co., Cleveland
Moline Tool Co., Moline, Ill.
National Acme Co., Cleveland
National Auto Tool Co., Richmond, Ind
Ohio Machine Tool Co., Kenton, O.
Sheffield Corp., Dayton, O.
Sellers & Co., Inc., Wm., Philadelphia
Snyder Tool & Engrg. Co., Detroit
Springfield Mach. Tool Co., Springfield, O
Universal Boring Mach. Co., Hudson, Mass.
Yoder Co., Cleveland

BORING MACHINES, Jig (See JIG-BORING MACHINES)

BORING MACHINES, Precision
Barnes Co., W. F. & John, Rockford, Ill
Bryant Machinery & Engrg. Co., Chicago
Ex-Cell-O Corp., Detroit
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Heald Machine Co., Worcester, Mass.
Leland-Gifford Co., Worcester, Mass.
Lucas Machine Tool Co., Cleveland
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Boston
Sheffield Corp., Dayton, O.
Stokerunit Corp., Milwaukee
Universal Boring Mach. Co., Hudson, Mass.

BORING MILLS, Vertical
Baush Mach. Tool Co., Springfield, Mass.
Bullard Co., Bridgeport, Conn.
Cincinnati Planer Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.

ELIMINATE HAND LABOR *by cleaning and finishing work on* #606 PEERLESS SURFACERS



This convenient machine meets a long-felt need for speeding up cleaning and finishing of castings, dies, stampings and similar work. It gives a straight line finish and leaves sharp edges. Heavily constructed, accurately balanced with ball bearings throughout, the No. 606 Peerless Bench Surfacer assures faster, better work with far less effort.

SPECIFICATIONS

Capacity—Work up to 6" wide — Length 22"
Belt speed 2,500 F.P.M. — Width 24"
Abrasive belt 6" x 42"

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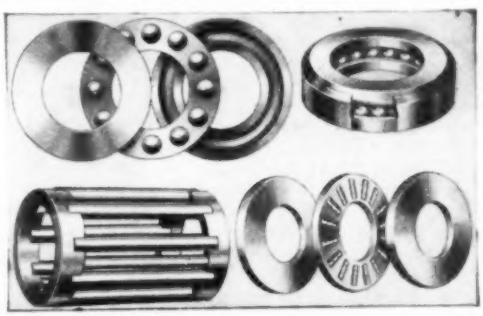

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Precision Bearings are selected for dependability and longer service. There is a marked distinction in the use of these bearings for heavy duty installations.

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LUCAS "PRECISION"

Horizontal Boring, Drilling and Milling Machine

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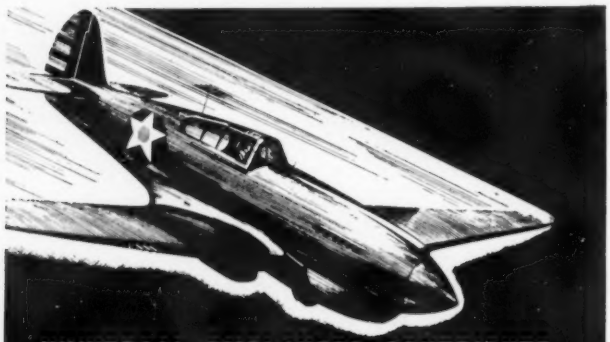

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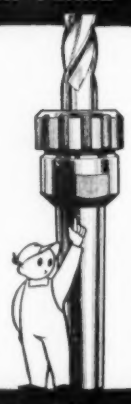

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FRANKENMUTH • MICHIGAN

WHERE-TO-BUY DIRECTORY

King Machine Tool Co., Cincinnati
Sellers & Co., Inc., Wm. Philadelphia
Springfield Mach. Tool Co., Springfield, O.

BOXES, Tote
American Metal Works, Inc., Philadelphia, Pa.
Lucas & Son, Inc., J. L., Bridgeport, Conn.
Standard Pressed Steel Co., Jenkintown Pa.

BRAKES, Bending, Power
Bryant Machinery & Engrg. Co., Chicago
Cincinnati Shaper Co., Cincinnati
Cleveland Crane & Engrg. Co., Wickliffe, O.
Cleveland Punch & Shear Wks. Co., Cleveland

BRAKES, Electric
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., E Pittsburgh

BRICK, Furnace (See REFRACTORIES)

BROACHES
American Broach & Machine Co., Ann Arbor, Mich.
Butterfield & Co., Derby Line, Vt.
Colonial Broach Co., Detroit
Dalzen Tool & Mfg. Co., Detroit
Detroit Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
East Shore Mach. Pdts. Co., Cleveland
Ex-Cell-O Corp., Detroit
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Lapointe Mach. Tool Co., Hudson, Mass.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

BROACHING MACHINES
American Broach & Machine Co., Ann Arbor, Mich.
Cincinnati Milling Mach. Co., Cincinnati
Colonial Broach Co., Detroit
Consolidated Machine Tool Corp., Rochester, N. Y.
Elmes Engrg. Works, Chas. F., Chicago
Foote-Burt Co., Cleveland
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lapointe Mach. Tool Co., Hudson, Mass.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
Thompson Grinder Co., Springfield, O.

BRONZE, Phosphor (See PHOSPHOR BRONZE)

BUFFERS & POLISHERS
Black & Decker Mfg. Co., Towson, Md.
Blount Co., J. G., Everett, Mass.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Continental Machines, Inc., Minneapolis
Delta Mfg. Co., Milwaukee
Dumore Co., Racine, Wis.
Gardner Machine Co., Beloit, Wis.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Haskins Co., R. G., Chicago
Heald Machine Co., Worcester, Mass.
Hill-Acme Co., Cleveland
Jefferson Mach. Tool Co., Cincinnati
Landis Tool Co., Waynesboro, Pa.
Mattison Machine Works, Rockford, Ill.
New Britain-Gridley Mach. Co., New Britain, Conn.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Rotor Tool Co., Cleveland
Schauer Machine Co., Cincinnati
Stow Mfg. Co., Binghamton, N. Y.
Strand & Co., N. A., Chicago
Union Twist Drill Co., Athol, Mass.
Vonnegut Moulder Corp., Indianapolis
Walker-Turner Co., Plainfield, N. J.

BUFFERS & POLISHERS, Hand
Behr-Manning Corp., Troy, N. Y.
Roberts Rubber Co., Weldon, Newark, N. J.

BULLDOZERS
Baldwin-Southwark Corp., Philadelphia
Beatty Mach. & Mfg. Co., Hammond, Ind.
Elmes Eng. Works, Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Watson-Stillman Co., Roselle, N. J.

BURNERS, Gas & Oil Furnace
American Gas Furn. Co., Elizabeth, N. J.
Hones, Inc., Charles A., Baldwin, N. Y.
Strong, Carlisle & Hammond Co., Cleveland
Surface Combustion Corp., Toledo, O.

BURNISHERS, Gear
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

BURNISHING MACHINES
Consolidated Machine Tool Corp., Rochester, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., Detroit
Sheffield Corp., Dayton, O.

BURRING MACHINES
Consolidated Mach. Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Hill Acme Co., Cleveland
National Broach & Machine Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

BUSHINGS, Drill
Carboloy Co., Detroit
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Metal Carbides Corp., Youngstown, O.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS Steel (See LOCKERS & SHELVING)

CALIPERS & COMPASSES
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Farrel-Birmingham Co., Ansonia, Conn.
Lufkin Rule Co., Saginaw, Mich.
Randall & Stickney, Waltham, Mass.
Scherr Co., Geo., N. Y. C.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS, Machine
Brown & Sharpe Mfg. Co., Providence, R. I.
Cross Gear & Machine Co., Detroit
Hartford Special Machinery Co., Hartford, Conn.
Kux Machine Co., Chicago
Weldon Tool Co., Cleveland

CARBURIZERS (See also BOXES, Heat-Treating & Annealing)
American Gas Furn. Co., Elizabeth, N. J.
Houghton & Co., E. F., Philadelphia
Surface Combustion Corp., Toledo, O.

CARTRIDGE-CASE FINISHING MACHINES
Coulter Mach. Co., Jas., Bridgeport, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.

CASTINGS
American Brake Shoe & Fdry. Co., N. Y. C.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bunting Brass & Bronze Co., Toledo
Etna Machine Co., Toledo, O.
Hill Acme Co., Cleveland
Jefferson Mach. Tool Co., Cincinnati
Johnson Bronze Co., New Castle, Pa.
Mattison Machine Wks., Rockford, Ill.
Springfield Mach. Tool Co., Springfield, O.

CEMENT, Belt
Desmond-Stephan Mfg. Co., Urbana, O.
Houghton & Co., E. F., Philadelphia
Rhoads & Sons, J. E., Philadelphia

CEMENT, Refractory
Carborundum Co., Niagara Falls, N. Y.
Norton Company, Worcester, Mass.

CENTERING MACHINES
Consolidated Mach. Tool Corp., Rochester, N. Y.
Hanson-Whitney Machine Co., Hartford, Conn.
Hendey Machine Co., Torrington, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Seneca Falls Mach. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Co., Rockford, Ill.

CENTERS, Bench
Brown & Sharpe Mfg. Co., Providence, R. I.

WHERE-TO-BUY DIRECTORY

Dearborn Gage Co., Dearborn, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Starrett Co., L. S., Providence, R. I.

CENTERS, Machine
Abrasive Mach. Tool Co., E. Providence, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Company, Bridgeport, Conn.
Carboloy Co., Detroit
Cincinnati Lathe & Tool Co., Cincinnati (Lathe only)
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Hendey Machine Co., Torrington, Conn.
Knight Machinery Co., W. B., St. Louis
McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney, Div. Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Sturdimatic Tool Co., Detroit
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vasco-loy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.

CENTRIFUGALS (See PURIFIERS, Oil & Coolant)

CENTRIFUGAL MACHINERY
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.

CHAIN, Forged-Steel Link
American Chain & Cable Co., Bridgeport, Conn.
Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
McKay Co., Pittsburgh
Scully Steel Products Co., Chicago

CHAINS, Conveyor
Allis-Chalmers Mfg. Co., Milwaukee
American Chain & Cable Co., Bridgeport, Conn.

CHAINS, Transmission
Bilgram Gear & Mach. Wks., Philadelphia
Cincinnati Gear Co., Cincinnati
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland

CHAMFERING MACHINES
Bilgram Gear & Mach. Wks., Philadelphia
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Lipe-Rollway Corp., Syracuse, N. Y.
Murchey Machine & Tool Co., Detroit
National Broach & Mach. Co., Detroit
Sheffield Corp., Dayton, O.

CHECKS, Metal, Time and Tool
Acromark Co., Elizabeth, N. J.
Noble & Westbrook Mfg. Co., East Hartford, Conn.
Revere Copper & Brass Inc., N. Y. C.

CHISELS, Hand (See TOOLS, Hand)

CHISELS, Chipping, Pneumatic & Electric Hammer
Bethlehem Steel Co., Bethlehem, Pa.
Black & Decker Mfg. Co., Towson, Md.
Cleveland Pneumatic Tool Co., Cleveland
Plomb Tool Co., Los Angeles, Calif.
Scully-Jones & Co., Chicago

CHUCKING MACHINES (See also LATHES, Automatic & Semi-Automatic)
Bullard Co., Bridgeport, Conn.
Cincinnati Lathe & Tool Co., Cincinnati
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Foote-Burt Co., Cleveland
Gisholt Machine Co., Madison, Wis.
Gorton, Mach. Co., George, Racine, Wis.
Goss & deLeeuw Mach. Co., New Britain, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Lees-Bradner Co., Cleveland
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland
Wickman Corp., Detroit

CHUCKS, Air (See CHUCKS, Pneumatic)

CHUCKS, Collet (See Collets)

CHUCKS, Drill & Tap
Atlas Press Co., Kalamazoo, Mich.
Errington Mech. Lab., Stapleton, N. Y.
Etteo Tool Co., Brooklyn, N. Y.
Gisholt Machine Co., Madison, Wis.
Horton & Son Co., E., Windsor Locks, Conn.
Jacobs Mfg. Co., Hartford, Conn.
McCrosky Tool Corp., Meadville, Pa.
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
North Bros., Mfg. Co., Philadelphia
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland

CHUCKS, Drill, Quick-Change, Collet
Errington Mech. Lab., Stapleton, N. Y.
Gairing Tool Co., Detroit
Modern Tool Works, Rochester, N. Y.
Scully-Jones & Co., Chicago

CHUCKS, Gear
Cushman Chuck Co., Hartford, Conn.
Gleason Works, Rochester, N. Y.
Sheffield Corp., Dayton, O.

CHUCKS, Hydraulic
Cross Gear & Machine Co., Detroit
Cushman Chuck Co., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
New Britain-Gridley Machine Div., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Warner & Swasey Co., Cleveland

CHUCKS, Lathe
Atlas Press Co., Kalamazoo, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Cushman Chuck Co., Hartford, Conn.
Delta Mfg. Co., Milwaukee
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Harnischfeger Corp., Milwaukee
Hendey Machine Co., Torrington, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
L-W Chuck Co., Toledo, O.
McCrosky Tool Corp., Meadville, Pa.
Potter & Johnston Machine Co., Pawtucket, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Boston
Scherr Co., Geo., N. Y. C.
Tomkins-Johnson Co., Jackson, Mich.

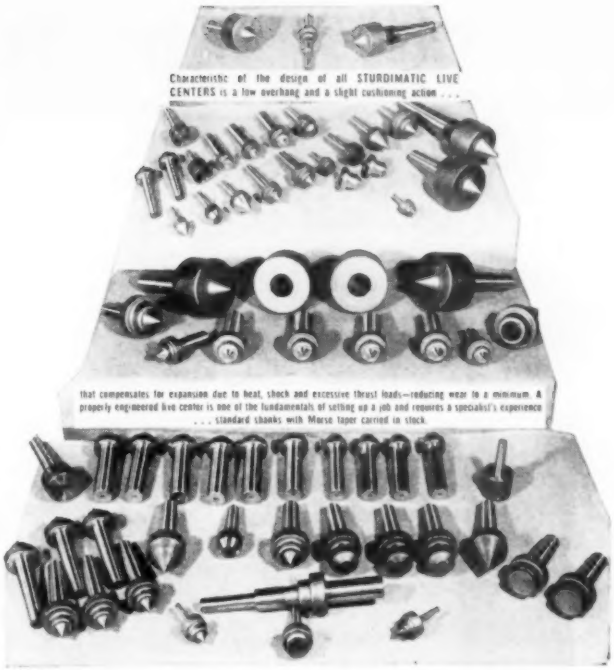
CHUCKS, Magnetic
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Heald Machine Co., Worcester, Mass.
L-W Chuck Co., Toledo, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S., Worcester, Mass.

CHUCKS, Motorized Electric
Cushman Chuck Co., Hartford, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland

CHUCKS, Pneumatic
Cushman Chuck Co., Hartford, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Warner & Swasey Co., Cleveland

CHUCKS, Ring-Wheel
Abrasive Mach. Tool Co., E. Providence, R. I.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Gardner Machine Co., Beloit, Wis.

CHUCKS, Spring
Brown & Sharpe Mfg. Co., Providence, R. I.
Harnischfeger Corp., Milwaukee
Rivett Lathe & Grinder, Inc., Boston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that compensates for expansion due to heat, shock and excessive thrust loads—reducing wear to a minimum. A properly engineered live center is one of the fundamentals of setting up a job and requires a specialist's experience . . . standard shanks with Morse taper carried in stock.

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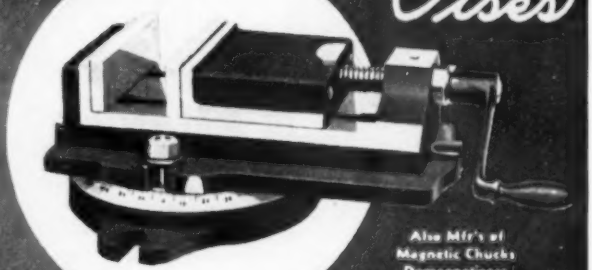
Vises



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HEAVY DUTY 6½" SIZE
$32.55

Suitable for milling machines, drill presses, shapers, etc., these large semi-steel vises may be used plain or swivel. The steel jaws are sturdy. Key slots provide for attachment to machine table holding surface, with jaws at right angle or parallel to table. Junior 4½" size, 45 pounds, **$23.60**

L-W CHUCK CO.
1-7 N. St. Clair St., Toledo, Ohio

NATIONAL KEYSEATING MILLER

. . . the tool that converts drilling machines into key-seaters *and saves time and money*

● With this modern tool you can handle keyseating jobs not suitable for keyseating machines on any of your drill presses or radials. Keyseats with parallel sides, accurate in depth and in perfect alignment with bore axis are assured.

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Excello Corp., Detroit (Heat Treating)
Fenn Mfg. Co., Hartford, Conn.
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Lincoln Electric Co., Cleveland
Monitor Controller Co., Baltimore, Md.
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Westinghouse Elec. & Mfg. Co., E. Pittsburgh

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Brown Instrument Co., Philadelphia
Lindberg Engrg. Co., Chicago

CONTROLS, Flexible-Shaft (See SHAFTS, Flexible)

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American Gas Furn. Co., Elizabeth, N. J.
Brown Instrument Co., Philadelphia
Lindberg Engrg. Co., Chicago
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COOLANTS, Cutting, Drilling & Grinding
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National Twist Drill & Tool Co., Detroit
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Starrett Co., L. S., Athol, Mass.

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Schrader's Son, A., Brooklyn, N. Y.

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Foote Bros. Gear & Mach. Co., Chicago
Hill Acme Co., Cleveland
Morse Chain Co., Ithaca, N. Y.
Nicholson & Co., W. H., Wilkes-Barre, Pa.

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General Electric Co., Schenectady, N. Y.
Hill Acme Co., Cleveland
Standard Pressed Steel Co., Jenkintown, Pa.

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Cleveland Crane & Engrg. Co., Wickliffe, O.
Curtis Pneumatic Machy. Co., St. Louis
Harnischfeger Corp., Milwaukee
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

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Curtis Pneumatic Machry. Co., St. Louis
Harnischfeger Corp., Milwaukee
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

CRANES, Portable
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Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

CUSHIONS, Die
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V. & O. Press Co., Hudson, N. Y.

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Butterfield & Co., Derby Line, Vt.
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National Twist Drill & Tool Co., Detroit
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Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
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C & W Tool Co., Cambridge, Mass.
Carboloy Co., Detroit
Cleveland Twist Drill Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Weldon Tool Co., Cleveland

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Brown & Sharpe Mfg. Co., Providence, R. I.
C & W Tool Co., Cambridge, Mass.
Cleveland Hobbing Mach. Co., Cleveland
Cross Gear & Machine Co., Detroit
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
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Standard Tool Co., Cleveland
Stow Mfg. Co., Binghamton, N. Y.
Taylor Machine Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Waltham Mach. Wks., Waltham, Mass.

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CUTTERS, Keyseater
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Davis Keyseater Co., Rochester, N. Y.
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Michigan Tool Co., Detroit
Mitts & Merrill, Saginaw, Mich.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
National Machine Tool Co., Cincinnati
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co. Hartford, Conn.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

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Cleveland Twist Drill Co., Cleveland
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Disston & Sons, Inc., Henry, Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa
Gairing Tool Co., Detroit
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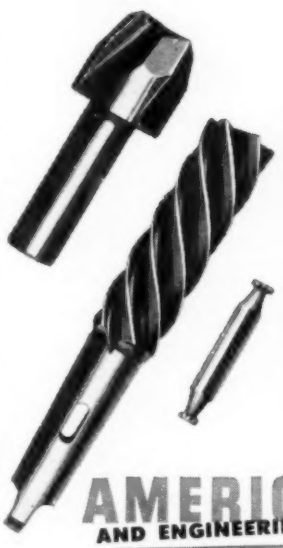

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DEGREASERS (See Metal Cleaning Equipment)

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Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
Oster Mfg. Co., Cleveland
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Starrett Co., L. S., Athol, Mass.

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Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

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Pratt & Whitney Div. Niles-Bemont-Pond Co., Hartford, Conn.
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Eastern Machine Screw Corp., New Haven, Conn.
Errington Mech. Lab., Stapleton, N. Y.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mach. Co., Springfield, Vt.
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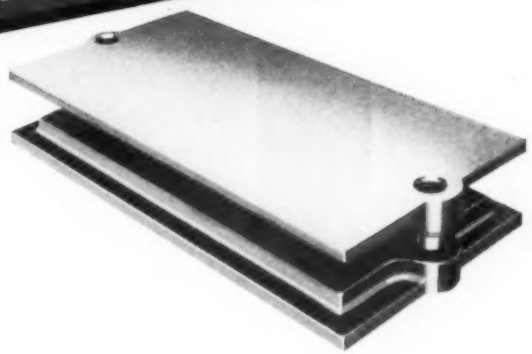

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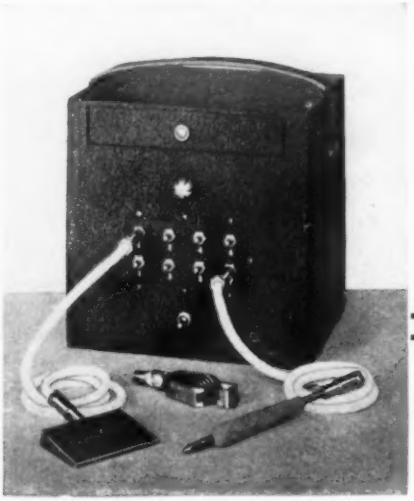

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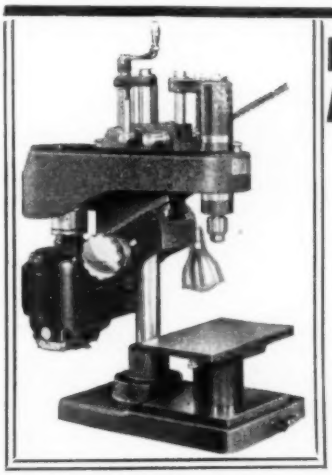

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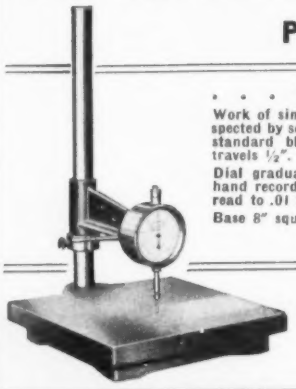

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Stark Tool Co., Waltham, Mass.
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Surface Combustion Corp., Toledo, O.

FURNACES, Oil
Chicago Flexible Shaft Co., Chicago
Surface Combustion Corp., Toledo

FURNITURE, Shop
Black & Decker Mfg. Co., Towson, Md. (Drill Stands)
Hamilton Tool Co., Hamilton, O.
New Britain-Gridley Machine Co., New Britain, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

GAGES, Amplifying
Federal Products Corp., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Van Keuren Co., Watertown, Mass.

GAGES, Caliper
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pal Tool Co., Minneapolis, Minn.
Sheffield Corp., Dayton, O.
Slocumb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg Co., Woonsocket, R. I.

GAGES, Comparator
American Measuring Instruments Corp., N. Y. C.
Ames Co., B. C., Waltham, Mass.
Federal Products Corp., Providence, R. I.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Continental Machines, Inc., Minneapolis
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.

GAGES, Dial
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Randall & Stickney, Waltham, Mass.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Drill-Center
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Morse Twist Drill Co., New Bedford, Mass.
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Starrett Co., L. S., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

GAGES, Height
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Lufkin Rule Co., Saginaw, Mich.
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

GAGES, Plug & Ring
Brown & Sharpe Mfg Co., Providence, R. I.
Cadillac Gage Co., Detroit
Carboloy Co., Detroit

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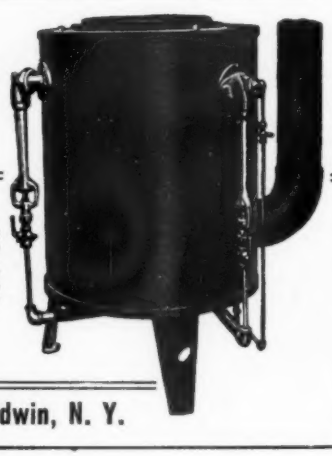

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Detroit Tap & Tool Co., Detroit
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Lincoln Park Tool & Gage Co., Lincoln Park, Mich.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T., Providence, R. I.
Standard Gage Co., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Gage Grinding Co., Ferndale, Mich.
Vard Inc., Pasadena, Calif.
Van Keuren Co., Watertown, Mass.

GAGES, Pressure
Baldwin-Southwark Corp., Philadelphia
Brown Instrument Co., Philadelphia

GAGES, Profile
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Snap (See GAGES, Plug & Ring)

GAGES, Surface
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

GAGES, Thickness
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Randall & Stickney Co., Waltham, Mass.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread
Brown & Sharpe Mfg. Co., Providence, R. I.
Cadillac Gage Co., Detroit
Detroit Tap & Tool Co., Detroit
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Mach. Co., Hartford, Conn.
Lufkin Rule Co., Saginaw, Mich.
Michigan Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T. Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.
Vinco Corp., Detroit

GAGES, Wire
Atkins & Co., E. C., Indianapolis
Brown & Sharpe Mfg. Co., Providence, R. I.
Disston & Sons, Inc., Henry, Philadelphia
Federal Products Corp., Providence, R. I.
Morse Twst Drill & Mach. Co., New Bedford, Mass.
Standard Tool Co., Cleveland
Starrett Co., L. S., Athol, Mass.

GALVANIZING MACHINES (See ENAMELING & GALVANIZING MACHINES

GASES, Compressed
Air Reduction, N. Y. C.

GEAR-CUTTING MACHINES
Adams Co., Dubuque, Iowa
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Cleveland Hobbing Mach. Co., Cleveland
Colonial Broach Co., Detroit
Cross Gear & Machine Co., Detroit
Farrell-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
General Mach. Corp., Hamilton, O.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
Newark Gear Cutting Mach. Co., Newark
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Waltham Mach. Wks., Waltham, Mass.

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Farrell-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.

GEARS, Cast
Braun Gear Corp., Brooklyn, N. Y.
Dodge Mfg. Corp., Mishawaka, Ind.
Earle Gear & Machine Co., Philadelphia
Fairfield Mfg. Co., Lafayette, Ind.
Farrel-Birmingham Co., Ansonia, Conn.
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
General Electric Co., Schenectady, N. Y.
Grant Gear Works, Inc., Boston
Ohio Gear Co., Cleveland
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia
Quaker City Gear Wks., Inc., Philadelphia

GEARS, Cut
Adams Co., Dubuque, Iowa
Allis-Chalmers Mfg. Co., Milwaukee
Baush Mach. Tool Co., Springfield, Mass.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Braun Gear Corp., Brooklyn, N. Y.
Carlyle Johnson Machine Co., Manchester, Conn.
Cincinnati Gear Co., Cincinnati
Detroit Bevel Gear Co., Detroit
Earle Gear & Machine Co., Philadelphia
Fairfield Mfg. Co., Lafayette, Ind.
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
Gear Specialties Inc., Chicago
Gleason Works, Rochester, N. Y.
Grant Gear Works, Inc., Boston
Hartford Special Machinery Co., Hartford, Conn.
Meisel Press Mfg. Co., Boston
Michigan Tool Co., Detroit
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia
Quaker City Gear Wks., Inc., Philadelphia
Sier-Bath Gear Co., North Bergen, N. J.
Stahl Gear & Machine Co., Cleveland

GEARS, Master
Earle Gear & Mach. Co., Philadelphia
Fellows Gear Shaper Co., Springfield, Vt.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
National Broach & Mach. Co. Detroit
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

GEARS, Non-Metallic
Adams Co., Dubuque, Iowa
Bakelite Corp., N. Y. C.
Bilgram Gear & Mach. Wks., Philadelphia
Braun Gear Corp., Brooklyn, N. Y.
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
Grant Gear Works Inc., Boston
Hartford Special Machinery Co., Hartford, Conn.
James Co., D. O., Chicago
Meisel Press Mfg. Co., Boston
Perkins Machine & Gear Co., Springfield, Mass.
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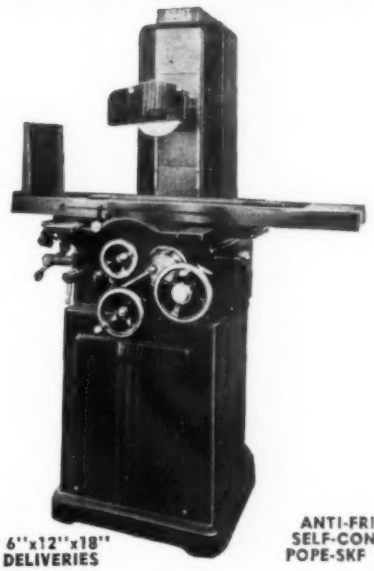

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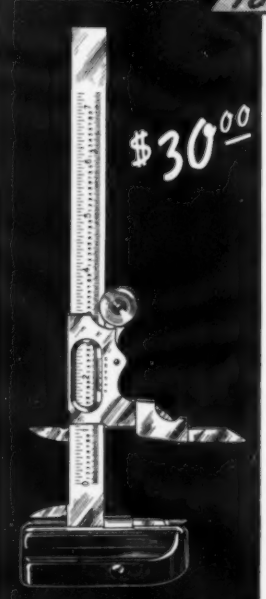

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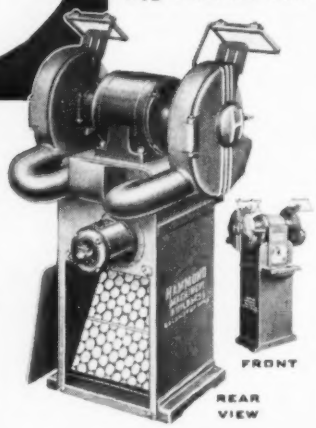

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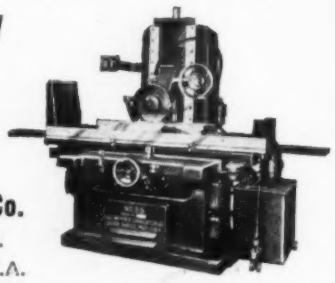

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Walker-Turner Co., Inc., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

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Hobart Brothers, Troy, Ohio
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Porter Cable Mach. Co., Syracuse, N. Y.
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Queen City Machine Tool Co., Cincinnati
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Walker-Turner Co., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

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Norton Co., Worcester, Mass.

GRINDERS, Carbide Tool
Blount Co., J. G., Everett, Mass.
Ex-Cell-O Corp., Detroit
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.

GRINDERS, Centerless
Cincinnati Grinders, Inc., Cincinnati
Heald Machine Co., Worcester, Mass.
Metal Carbides Corp., Youngstown, O.

GRINDERS, Chucking
Blanchard Machine Co., Cambridge, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Mach. Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDERS, Contour
Baker Bros., Inc., Toledo, Ohio
Blanchard Machine Co., Cambridge, Mass.
Thompson Grinder Co., Springfield, O.

GRINDERS, Cutter & Tool
Abrasive Mach. Tool Co., E. Providence, R. I.
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Blount Co., J. G., Everett, Mass.
Boggis & Co., H. P., Cleveland
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
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Cincinnati Milling Mach. Co., Cincinnati
Continental Machines, Inc., Minneapolis
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Delta Mfg. Co., Milwaukee
Ex-Cell-O Corp., Detroit
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Fitchburg Grinding Machine Corp., Fitchburg, Mass.
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Geometric Tool Co., New Haven, Conn.
Gorton Machine Co., Geo., Racine, Wis.
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Heald Machine Co., Worcester, Mass.
Kearney & Trecker Co., Milwaukee
Landis Machine Co., Waynesboro, Pa.
Landis Tool Co., Waynesboro, Pa.
LeBlond Mach. Tool Co., R. K., Cincinnati
National Acme Co., Cleveland
Norton Co., Worcester, Mass.
Oliver Instrument Co., Adrian, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Scherr Co., Inc., Geo., N. Y. C.
Seliers & Co., Inc., Wm., Philadelphia
Standard Tool Co., Cleveland
Sundstrand Mach. Tool Co., Rockford Ill.
Thompson Grinder Co., Springfield, O.
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Cylindrical
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Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Grinders, Inc., Cincinnati
Dumore Co., Racine, Wis.
Farrel-Birmingham Co., Ansonia, Conn.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., Bedford, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Thompson Grinder Co., Springfield, O.

GRINDERS, Disk
Delta Mfg. Co., Milwaukee
Fitchburg Gringing Machine Corp. Fitchburg, Mass.
Gardner Machine Co., Beloit, Wis.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Lempco Products, Inc., Bedford, O.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Queen City Mach. Tool Co., Cincinnati
Wall Sales Corp., N. Y. C.

GRINDERS, Drill & Tap
Blake Co., Edward, Newton Center, Mass.
Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Seliers & Co., Wm., Philadelphia
Union Twist Drill Co., Athol, Mass.

GRINDERS, Face or Ring Wheel
Abrasive Mach. Tool Co., E. Providence R. I.
Blanchard Machine Co., Cambridge, Mass.
Blount Co., J. G., Everett, Mass.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Bickford Tool Co., Oakley, Cincinnati
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Lempco Products, Inc., Bedford, O.

GRINDERS, Gear
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gear Grinding Machine Co., Detroit
Gleason Works, Rochester, N. Y.
Lees-Bradner Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

GRINDERS, Internal
Arter Grinding Mach. Co., Worcester, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Hartford Special Machinery Co., Hartford, Conn.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., Bedford, O.
Rivett Lathe & Grinder, Inc., Boston
Sav-Way Industries, Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Thompson Grinder Co., Springfield, O.
Van Norman Machine Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Jig
Moore Spec. Tool Co., Bridgeport, Conn.

GRINDERS, Knife & Shear-Blade
Abrasive Mach. Tool Co., E. Providence R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Atkins & Co., E. C., Indianapolis

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Hill-Acme Co., Cleveland
Mattison Machine Works, Rockford, Ill.

GRINDERS, Lathe-Attachment (See ATTACHMENTS, Lathe)

GRINDERS, Portable Electric (See also TOOLS, Portable Electric)
Black & Decker Mfg. Co., Towson, Md.
Chicago Wheel & Mfg Co., Chicago
Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine, Wis.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Haskins Co., R. G., Chicago
Porter-Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rotor Tool Co., Cleveland

GRINDERS, Spline
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDERS, Surface
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Atlantic Machinery Co., N. Y. C.
Blanchard Mach. Co., Cambridge, Mass.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Gardner Machine Co., Beloit, Wis.
Hammond Machy. Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., Worcester, Mass.
Hill-Acme Co., Cleveland
Landis Tool Co., Waynesboro, Pa.
Leach Machinery Co., H., Providence, R. I.
Mattison Machine Works, Rockford, Ill.
Murchey Machine & Tool Co., Detroit
Norton Co., Worcester, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Thompson Grinder Co., Springfield, O.
Van Norman Machine Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Swing-Frame
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Jefferson Machine Tool Co., Cincinnati
Vonnegut Moulder Corp., Indianapolis

GRINDERS, Thread
Ex-Cell-O Corp., Detroit
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.

GRINDERS, Universal
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati
Covel Mfg. Co., Benton Harbor, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Landis Tool Co., Waynesboro, Pa.
LeBlond Mach. Tool Co., R. K., Cincinnati
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Thompson Grinder Co., Springfield, O.

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GRINDING FIXTURES
Industrial Engrg. Co., Inc., Minneapolis

GROOVERS, Oil
Hanson-Whitney Mach. Co., Hartford, Conn.
National Machine Tool Co., Cincinnati

GUARDS & SAFETY APPLIANCES, Machinery
Littleford Bros., Cincinnati
Schrader's Son, A., Brooklyn, N. Y.

HACK SAW BLADE GRINDING FIXTURES (See GRINDING FIXTURES)

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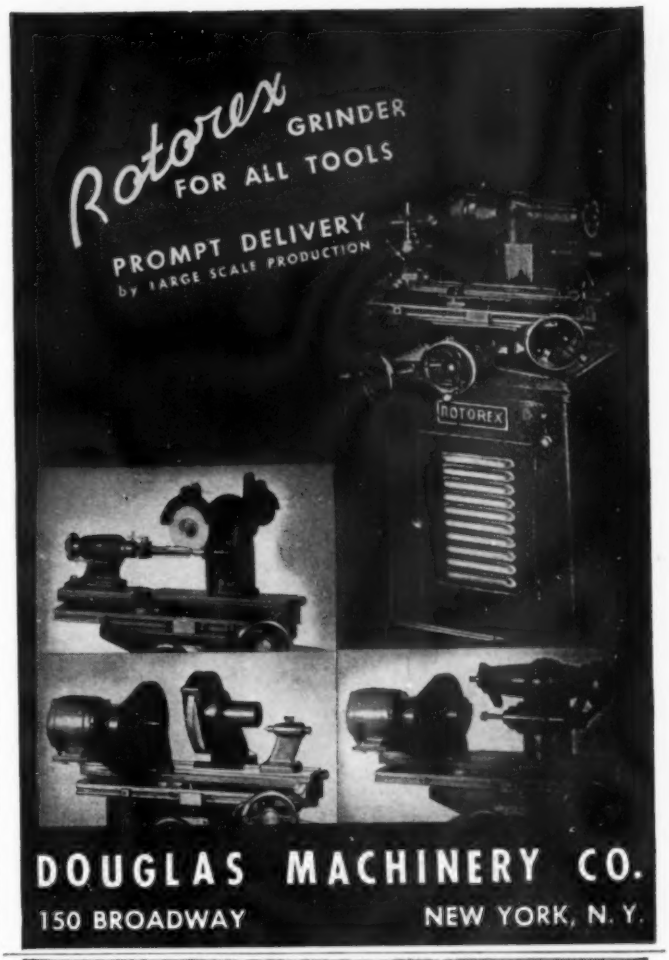

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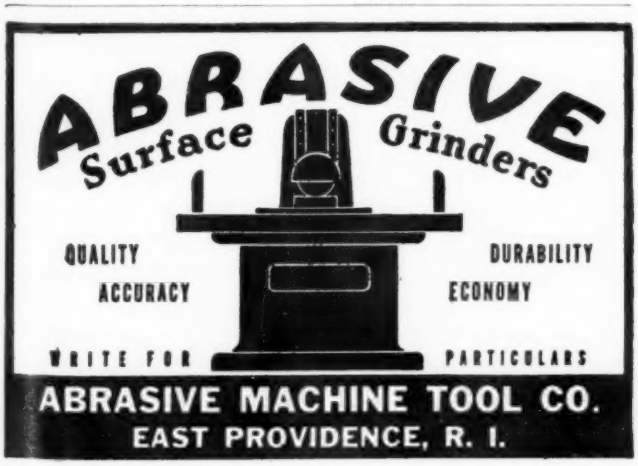

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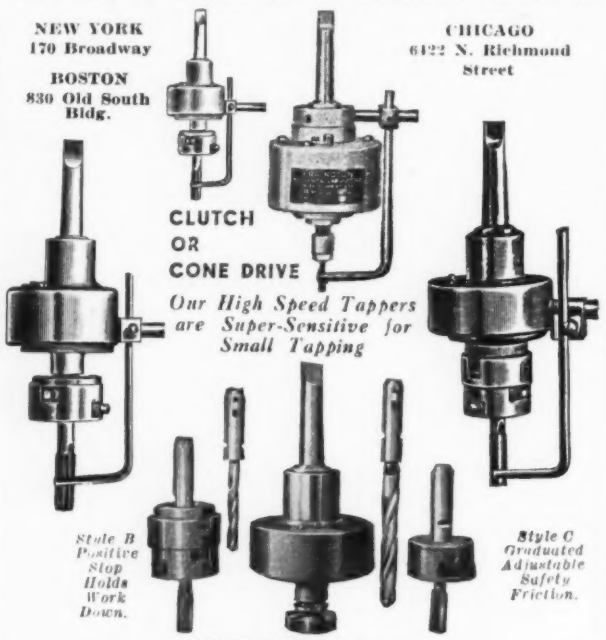

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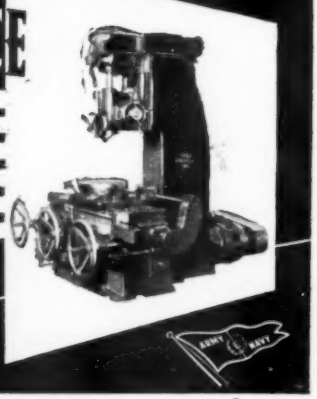

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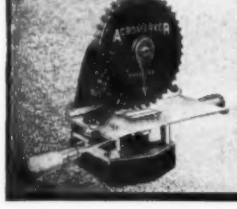

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Kearney & Trecker Corp., Milwaukee
Morse Twist Drill & Machine Co., New Bedford, Mass.
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Brewster Squires & Co., N. Y. C.
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Mathews & Co., James H., Pittsburgh
Noble & Westbrook Mfg. Co., East Hartford, Conn.
Numberall Stamp & Tool Co., Huguenot Park, N. Y.

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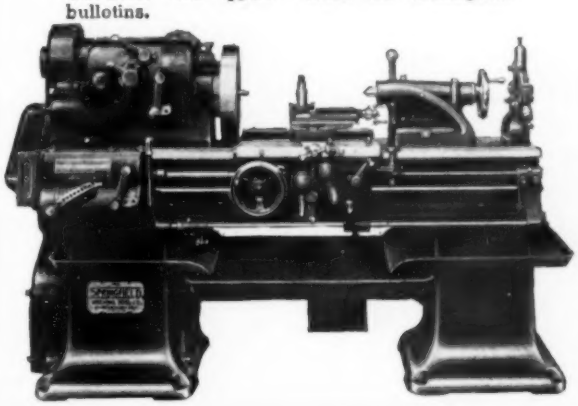

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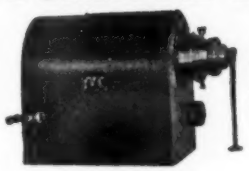

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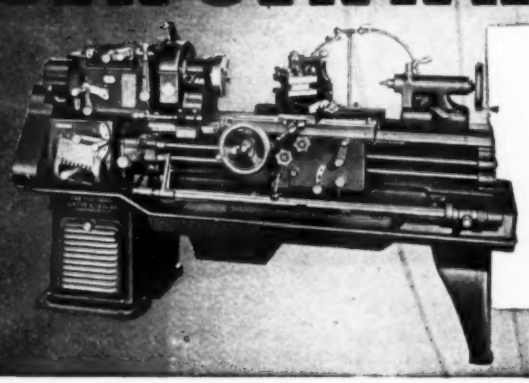

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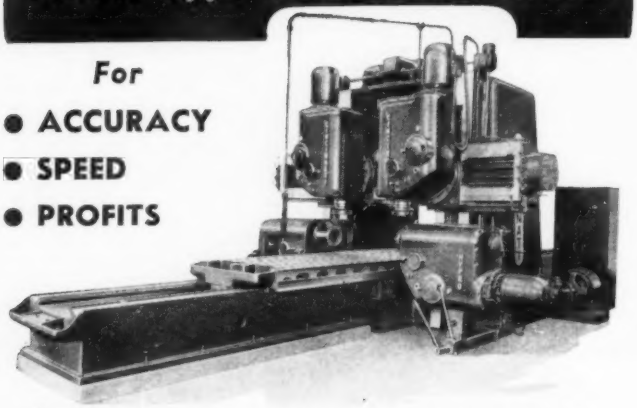

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Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
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Kent-Owens Machine Co., Toledo, O.
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Nichols & Sons, W. H., Waltham, Mass.
Producto Machine Co., Bridgeport, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.
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Cincinnati Milling Mach. Co., Cincinnati
Douglas Machinery Co., Inc., N. Y. C.
Fray Mach. Tool Co., Glendale, Calif.
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Granite State Mach. Co., Inc., Manchester, N. H.
Hardinge Brothers, Inc., Elmira, N. Y.
Jefferson Mach. Tool Co., Cincinnati
Kearney & Trecker Corp., Milwaukee
Kempsmith Machine Co., Milwaukee
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Lucas & Son, Inc., J. L., Bridgeport, Conn.
Knight Machinery Co., W. B., St. Louis
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Nichols & Sons, W. H., Waltham, Mass.
Ohio Machine Tool Co., Kenton, O.
Producto Machine Co., Bridgeport, Conn.
Sidney Machine Tool Co., Sidney, O.
Van Norman Machine Tool Co., Springfield, Mass.

MILLERS, Planer Type
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Sellers & Co., Inc., Wm., Philadelphia

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Hall Planetary Co., Philadelphia
Plan-O-Mill Corp., Royal Oak, Mich.

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Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
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Waltham Mach. Works, Waltham, Mass.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Coulter Machine Co., James, Bridgeport, Conn.
General Machinery Corp., Hamilton, O.
Gorton Machine Co., Geo., Racine, Wis.
Granite State Mach. Co., Inc., Manchester, N. H.
Hardinge Brothers, Inc., Elmira, N. Y.
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Kearney & Trecker Corp., Milwaukee
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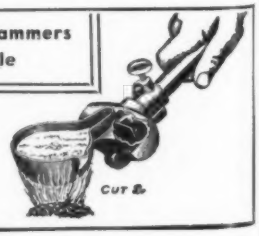

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Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit

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Sinclair Refining Co., N. Y. C.
Socony-Vacuum Oil Co., N. Y. C.
Standard Oil Co. (Ind.), Chicago
Sun Oil Co., Philadelphia
Texas Co., N. Y. C.
Tidewater Associated Oil Co., N. Y. C.

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Sinclair Refining Co., N. Y. C.
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Standard Oil Co. (Ind), Chicago
Stuart Oil Co., D. A., Chicago
Sun Oil Co., Philadelphia
Texas Co., N. Y. C.
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PACKING, Hydraulic
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Greene, Tweed & Co., N. Y. C.
Houghton & Co., E. F., Philadelphia
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Consolidated Mach. Tool Corp., Rochester, N. Y.
General Machinery Corp., Hamilton, O.
Ohio Machine Tool Co., Kenton, O.
Sellers & Co., Wm., Philadelphia

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PLATES, Surface
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Delta Mfg. Co., Milwaukee
Lombard Governor Corp., Ashland, Mass.
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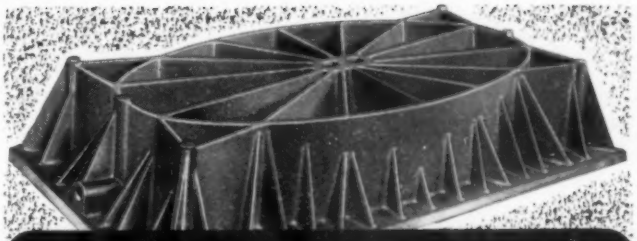

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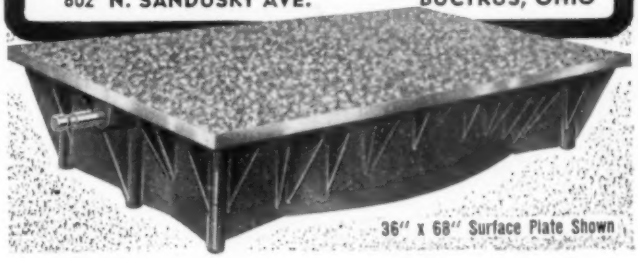

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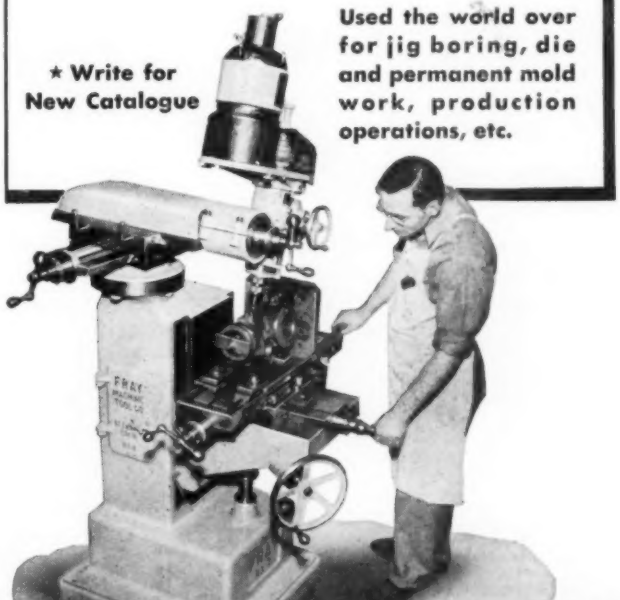

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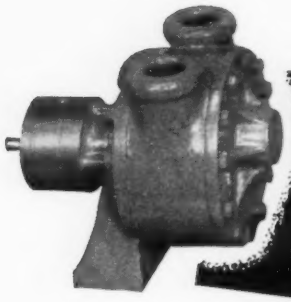

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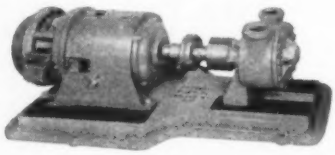

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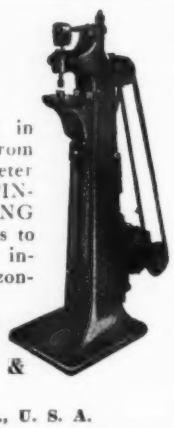

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Sheldon Machine Co., Chicago
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Niagara Mach. & Tool Wks., Buffalo, N. Y.
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PRESSES, Forging
Baldwin-Southwark Corp., Philadelphia
Beatty Mach. & Mfg. Co., Hammond, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Clearing Machine Corp., Chicago
Cleveland Punch & Shear Works Co., Cleveland
Elmes Engrg. Wks., Chas. F., Chicago
Hill Acme Co., Cleveland
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Watson-Stillman Co., Roselle, N. J.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, Hydraulic
American Broach & Machine Co., Ann Arbor, Mich.
Atlas Press Co., Kalamazoo, Mich.
Baldwin-Southwark Corp., Philadelphia
Beatty Mach. & Mfg. Co., Hammond, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Clearing Machine Corp., Chicago
Colonial Broach Co., Detroit
Davis Keyseater Co., Rochester, N. Y.
Elmes Engrg. Wks., Chas. F., Chicago
Farrel-Birmingham Co., Ansonia, Conn.
General Machinery Corp., Hamilton, O.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lapointe Mach. Tool Co., Hudson, Mass.
Lempco Products, Inc., Bedford, O.
Tomkins-Johnson Co., Jackson, Mich.
Watson-Stillman Co., Roselle, N. J.
Wright Mfg. Div. Amer. Chain Co., Inc., Bridgeport, Conn.

PRESSES, Power (Punch)
Beatty Mach. & Mfg. Co., Hammond, Ind.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati
Clearing Mach. Co., Chicago
Cleveland Crane & Engrg. Co., Steelweld Machry. Div., Wickliffe, Ohio
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Davis Keyseater Co., Rochester, N. Y.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hendey Machine Co., Torrington, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Kent-Owens Machine Co., Toledo, O.
Lempco Products, Inc., Bedford, O.
Mitts & Merrill, Saginaw, Mich.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Nilson Mach. Co., A. H. Bridgeport, Conn.
Ryerson & Son, Inc., Jos. T., Chicago
Schatz Mfg. Co., Poughkeepsie, N. Y.
V. & O. Press, Hudson, N. Y.
Wiedemann Machine Co., Philadelphia
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, Screw
Barnes Co., W. F. & John, Rockford, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Producto Machine Co., Bridgeport, Conn.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Wright Mfg. Div., American Chain & Cable Co., York, Pa.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, Straightening
Baldwin-Southwark Corp., Philadelphia
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Elmes Engrg. Wks., Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Morse Twist Drill & Mach. Co., New Bedword, Mass.
Nilson Mach. Co., A. H., Bridgeport, Conn.
Springfield Mach. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

PRESSES, Turret Punch
Federal Press Co., Elkhart, Ind.
Wiedemann Machine Co., Philadelphia

PROFILERS (See MILLERS, Vertical)

PROJECTORS, Contour
Jones & Lamson Machine Co., Springfield, Vt.
Portman Machine Tool Co., Mt. Vernon, N. Y.
Scherr Co., Geo., N. Y. C.

PROTRACTORS, Optical
Scherr Co., Geo., N. Y. C.

PULLEYS, Iron, Steel & Wood
American Pulley Co., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Carlyle Johnson Machine Co., Manchester, Conn.
Dayton Rubber Mfg. Co., Dayton, O.
Dodge Mfg. Corp., Mishawaka, Ind.
Hill Acme Co., Cleveland
Reeves Pulley Co., Columbus, Ind.

PULLEYS, V-Belt (See SHEAVES, V-Belt)

PUMPS, Centrifugal
Allis-Chalmers Mfg. Co., Milwaukee
Brown & Sharpe Mfg. Co., Providence, R. I.
Pioneer Engrg. & Mfg. Co., Detroit
Ruthman Machry. Co., Cincinnati
Tomkins-Johnson Co., Jackson, Mich.

PUMPS, Hydraulic
Allis-Chalmers Mfg. Co., Milwaukee
Baldwin-Southwark Corp., Philadelphia
Barnes Co., W. F. & John, Rockford, Ill.
Elmes Engrg. Wks., Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lapointe Mach. Tool Co., Hudson, Mass.
Racine Tool & Machine Co., Racine, Wis.
Sundstrand Mach. Tool Co., Rockford, Ill.
Tuthill Pump Co., Chicago
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.

PUMPS, Lubricant and Coolant
Bijur Lubricating Corp., Long Island City, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buffalo Forge Co., Buffalo, N. Y.
Gray Mills Co., Chicago
Pioneer Engrg. & Mfg. Co., Detroit
Rivett Lathe & Grinder, Inc., Boston

WHERE-TO-BUY DIRECTORY

Ruthman Machinery Co., Cincinnati
Sundstrand Mach. Tool Co., Rockford, Ill.
Tompkins-Johnson Co., Jackson, Mich.
Tuthill Pump Co., Chicago
Vickers, Inc., Detroit

PUNCHES, Center & Hand (See TOOLS, Hand)

PURIFIERS, Oil & Coolant
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.

PYROMETERS, Indicating & Recording
Brown Instrument Co., Philadelphia

QUENCHERS
American Gas Furn. Co., Elizabeth, N. J.
Farrel-Birmingham Co., Buffalo, N. Y.
Gleason Works, Rochester, N. Y.

RACKS, Gear (See GEARS, Cut)

RASPS (See FILES & RASPS)

RATCHETS (See GEARS, Cut)

REAMERS, Adjustable
Barber-Colman Co., Rockford, Ill.
Black Drill Co., Cleveland
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Detroit
Cleveland Twist Drill Co., Cleveland
Colonial Broach Co., Detroit
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.

REAMERS, Pipe
American Swiss File & Tool Co., Elisabeth, N. J.
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Cleveland Twist Drill Co., Cleveland
Detroit Tap & Tool Co., Detroit
Gairing Tool Co., Detroit
Greenfield Tap & Die Corp., Greenfield, Mass.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Oster Mfg. Co., Cleveland
Standard Tool Co., Cleveland
Torrington Co., Torrington, Conn.

REAMERS, Shell
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Greenfield Tap & Die Corp., Greenfield, Mass.
Illinois Tool Works, Chicago
Morse Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Schults & Anderson Co., Newark, N. J.
Union Twist Drill Co., Athol, Mass.

REAMERS, Solid
American Cutter & Engrg. Corp., Warren, Mich.
Barber-Colman Co., Rockford, Ill.
Butterfield & Co., Derby Line, Vt.
C & W Tool Co., Cambridge, Mass.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Garing Tool Co., Detroit
Genesee Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., N. Y. C.
Holman Reamer Co., Manchester, Conn.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Wendt Sonis Co., Hannibal, Mo.

REAMING MACHINES
Blanchard Machine Co., Cambridge, Mass.
Barnes Co., W. F. & John, Rockford, Ill.
Cleveland Pneu. Tool Co., Cleveland
Rotor Tool Co., Cleveland
Van Norman Machine Tool Co., Springfield, Mass.

RECORDERS, Speed (See INDICATORS, Speed)

RECORDERS, Temperature & Pressure
Brown Instrument Co., Philadelphia

REDUCERS, Motorized Speed
Allis-Chalmers Mfg. Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Dumore Co., Racine, Wis.
Earle Gear & Machine Co., Philadelphia
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
James Co., D. O., Chicago
Meisel Press Mfg. Co., Boston, Mass.
Ohio Gear Co., Cleveland
Philadelphia Gear Works, Philadelphia
Reliance Elec. & Engrg. Co., Cleveland
Wagner Electric Corp., St. Louis
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

REDUCERS, Speed
Adams Co., Dubuque, Iowa
Davis & Thompson Co., Milwaukee
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
General Machinery Corp., Hamilton, O.
Grant Gear Works, Inc., Boston
James Co., D. O., Chicago
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland
Philadelphia Gear Works, Philadelphia
Racine Tool & Mach. Co., Racine, Wis.
Stahl Gear & Machine Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

REELS, Strip-Stock & Wire
Nilson Mach. Co., A. H., Bridgeport, Conn.
Yoder Co., Cleveland

REFRACTORIES
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.
Strong, Carlisle & Hammond Co., Cleveland

REFRIGERATORS, Industrial
Deep Freeze Division, Motor Products Corp., Chicago

REGULATORS, Speed
Vickers, Inc., Detroit

REGULATORS, Temperature
American Gas Furn. Co., Elizabeth, N. J.
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence,

RIFLING MACHINES, Gun
American Broach & Machine Co., Ann Arbor, Mich.
Illinois Tool Works, Chicago
LeBlond Mach. Tool Co., R. K., Cincinnati
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

RIVETERS, Electric Power
Buffalo Forge Co., Buffalo, N. Y.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Linley Bros. Co., Bridgeport, Conn.
Tomkins-Johnson Co., Jackson, Mich.

RIVETERS, Pneumatic & Hydraulic
Baldwin-Southwark Corp., Philadelphia
Cleveland Pneu. Tool Co., Cleveland
Elmes Engrg. Wks., Chas. F., Chicago
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Watson-Stillman Co., Roselle, N. J.

RIVETS
Aluminum Co. of America, Pittsburgh
American Steel & Wire Co., Pittsburgh
Bethlehem Steel Co., Bethlehem, Pa.

ROLLS, Bending
Baldwin-Southwark Corp., Philadelphia
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
General Machinery Corp., Hamilton, O
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago

ROLLS, Forging
Bethlehem Steel Co., Bethlehem, Pa.

ROPE, Wire
American Cable Div. of Am. Chain & Cable Co., N. Y. C.
Bethlehem Steel Co., Bethlehem, Pa.
Page Steel & Wire Div., Am. Chain & Cable Co., Monessen, Pa.
Roebling's Sons Co., John A., Trenton, N. J.
Ryerson & Son, Inc., Jos. T., Chicago

ROUTERS
Consolidated Mach. Tool Corp., Rochester, N. Y.
Gorton Machine Co., Geo., Racine, Wis.
Knight Machy. Co., W. B., St. Louis
Onsrud Machine Works, Chicago
Reed-Prentice Corp., Worcester, Mass.

RULES & TRIANGLES, Machinists'
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Master Rule Co., N. Y. C.
Starrett Co., L. S., Athol, Mass.
Van Keuren Co., Watertown, Mass.

RUSTPROOFING & SLUSHING COMPOUNDS
Bakelite Corp., N. Y. C.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Oakite Products Co., N. Y. C.
Socony-Vacuum Oil Co., Inc., N. Y. C.
Standard Oil Co. of Indiana, Chicago
Tidewater Oil Co., N. Y. C.
Turco Products, Inc., Los Angeles

SAFETY EQUIPMENT
American Optical Co., Southbridge, Mass.
Littleford Bros., Cincinnati

SANDERS, Machine & Portable
Black & Decker Mfg. Co., Towson, Md.
Carborundum Co., Niagara Falls, N. Y.
Delta Mfg. Co., Milwaukee
Haskins Co., R. G., Chicago
Jefferson Machine Tool Co., Cincinnati
Mattison Machine Works, Rockford, Ill.
Porter-Cable Mach. Co., Syracuse, N. Y.

Gusher Pumps give you a copious, dependable, trouble-free flow of coolant for speedy, efficient production. You get the advantages of many *patented and exclusive* features.

The leaders in machine tool production depend on Gusher Pumps. Our line includes immersed types, tank units, pipe-connected types, flange-mounted types and plain drive types.

From a dribble to 200 g. p. m. Learn what the leader in the coolant pump field has to offer you. There's a Gusher to meet your needs. Write.

Model 5-P3

This new Gusher has a large mounting flange so as to be interchangeable with larger Gusher Pumps. Right or left discharge. 1/10 H.P. Maximum Capacity; 10 g. p. m.

THE RUTHMAN MACHINERY CO.
1809 READING ROAD CINCINNATI, OHIO
LARGEST EXCLUSIVE BUILDERS OF COOLANT PUMPS

HOLMAN *BETTER, FASTER HOLE FINISHING*

HELICAL TAPER PIN REAMERS

Scientifically made of selected steel under modern processes. Long lived, economical, accurate. Details on request.

HOLMAN REAMER CO.
MANCHESTER, CONN.

GET THE JUMP ON YOUR JOB

WITH THIS PRECISION

MASTER RULE

Here's a watch-pocket rule for watch-like accuracy — the MASTER STREAMLINE 6-ft. steel tape. With it you can do better work — more easily because of its many handy features.

You can whip it out in an instant to serve as inside calipers, outside calipers, a depth gauge and a straight edge. You get precision at a glance — no matter which way you use it.

A flick of your finger operates the lock of a Master STREAMLINE Rule, secures for you the exact measurement for as long as you need it. This feature plus Master's extra big, extra legible numerals simplifies work at close quarters and in poor light.

Notice Master's precision graduations in sixteenths of inches and hundredths of feet. An extra blade — easily inserted — gives you double life from the rule. See the Master Streamline at your hardware dealer's or mail us the coupon today.

Complete with spare blade

$2.65

MASTER RULE MFG. CO. 815 E. 136 St. N. Y. C., Dept. P2
Please send one-blade "Streamline" 6-ft. steel tape rule postpaid, complete with spare blade. ☐ Check here if tenths-hundredths graduation. I enclose $2.65 (check, cash or M. O.).

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Address_____

City_____ State_____

MASTER* YOUR WAR JOB WITH THE HANDY *RULE

MASTER

WOOD AND TAPE RULES

INTRICATE COMPRESSION DIE

made in 3-operations

CASE HISTORY NO. 8: After the blank is bored and the design scribed on its surface—a roughing and finishing cut is made with the SLOTMASTER. The finish cut is held to one and two thousandths, and so accurately done, it was found that when checking the die by rotating the lapping punch from position to position, it could be pressed through the die in any position . . . The lapping operation requires a man's time only for set-up. It is started by lowering the punch to the mouth of the die opening and then setting the down stroke of the Slotter so that it will completely compress the coil spring. As the spring relaxes, the punch works its way through the die as a result of the spring pressure and the stroking of the Slotter. Thumbnail illustrates set-up.

SLOTMASTER can be used on any round or flat-on round over-arm milling machine and will do precision work that normally requires a multi-thousand dollar machine (all of the working parts are of tool steel, heat treated). It takes but little time to change over from one head to the other . . . the stroke of the ram is adjustable from 0 to 4" . . . the speeds range from 50 to 250 s.p.m. The tool holder is of the clapper box type and can be turned in any position. SLOTMASTER comes complete with pulleys, motor, mounting bracket, etc.

Send for 4-page catalog — give specifications of the milling machines you wish to equip. Immediate deliveries on high priorities.

EXPERIMENTAL TOOL & DIE CO.
12609 GREINER
DETROIT, MICH.

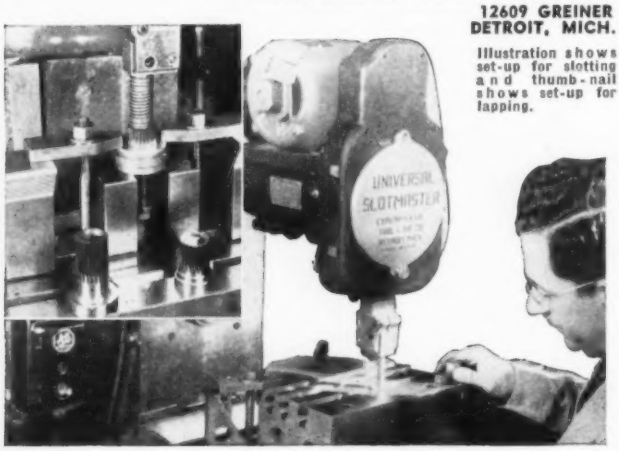

Illustration shows set-up for slotting and thumb-nail shows set-up for lapping.

WHERE-TO-BUY DIRECTORY

Production Mach. Co., Greenfield, Mass.
Rotor Tool Co., Cleveland
Skilsaw, Inc., Chicago
Stow Mfg. Co., Binghamton, N. Y.
Strand Co., N. A., Chicago
Walker-Turner Co., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

SAW BLADE GRINDING FIXTURES
Industrial Engrg. Co., Inc., Minneapolis

SAW BLADES, Circular Metal-Cutting
Atkins & Co., E. C., Indianapolis
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland

SAW BLADES, Hack & Band (See **BLADES, Hack & Band-Saw**)

SAWS, Band, Metal-Cutting (Machines)
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C. Indianapolis
Avey Drilling Mach. Co., Cincinnati
Capewell Mfg. Co., Hartford, Conn.
Continental Machines, Inc., Minneapolis
Delta Mfg. Co., Milwaukee
Peerless Machine Co., Racine, Wis.
Racine Tool & Machine Co., Racine, Wis.
Reed-Prentice Corp., Worcester, Mass.
Ryerson & Son, Inc., Jos. T., Chicago
Starrett Co., L. S., Athol, Mass.
Walker-Turner Co., Plainfield, N. J.
Wells Mfg. Corp., Three Rivers, Mich.

SAWS, Circular, Metal-Cutting (Machines)
Consolidated Mach. Tool Corp., Rochester, N. Y.
Delta Mfg. Co., Milwaukee
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Earle Gear Machine Co., Philadelphia
Motch & Merryweather Co., Cleveland
Porter-McLeod Machine Tool Co., Hatfield, Mass.

SAWS, Circular, Wood-Cutting (Machine)
Atkins & Co., E. C., Indianapolis
Curtis Pneumatic Machy. Co., St. Louis
Delta Mfg. Co., Milwaukee
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Mattison Machine Works, Rockford, Ill.
Walker-Turner Co., Inc., Plainfield, N. J.

SAWS, Friction
Ryerson & Son, Inc., Jos. T., Chicago

SAWS, Hack (See **TOOLS, Hand**)

SAWS, Hole
Armstrong-Blum Co., Chicago
Atkins & Co., E. C., Indianapolis
Avey Drilling Mach. Co., Cincinnati
Black & Decker Mfg. Co., Towson, Md.
Earle Gear & Machine Co., Philadelphia
Schrader's Sons, A., N. Y. C.
Skilsaw, Inc., Chicago

SAWS, Portable (See **TOOLS, Portable**)

SAWS, Power Hack
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C., Indianapolis
Capewell Mfg. Co., Hartford, Conn.
Covel Mfg. Co., Benton Harbor, Mich.
L-W Chuck Co., Toledo, Ohio
Oster Mfg. Co., Cleveland
Peerless Machine Co., Racine, Wis.
Racine Tool & Mach. Co., Racine, Wis.
Ryerson & Son, Inc., Jos. T., Chicago

SCRAPERS, Belt
Rhoads & Sons, J. E., Philadelphia

SCRAPERS, Hand (See **TOOLS, Hand**)

SCRAPERS, Power
Black & Decker Mfg. Co., Towson, Md.

SCREWDRIVERS, Flexible-Shaft (See **TOOLS, Flexible-Shaft**)

SCREWDRIVERS, Hand (See **TOOLS, Hand**)

SCREWDRIVERS, Portable Electric & Pneumatic (See **TOOLS, Portable**)

SCREWDRIVING & NUT-SETTING MACHINES
Bodine Corp., Bridgeport, Conn.
Haskins Co., R. G., Chicago
Producto Machine Co., Bridgeport, Conn.
Schauer Machine Co., Cincinnati
Strand & Co., N. A., Chicago

SCREW-MACHINES, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Foote-Burt Co., Cleveland
Greenlee Bros. & Co., Rockford, Ill.
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.
Scherr Co., Inc., George, N. Y. C.
Warner & Swasey Co., Cleveland

SCREW-MACHINES, Plain & Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Jones & Lamson Mach. Co., Springfield, Vt.
National Acme Co., Cleveland
Rivett Lathe & Grinder, Inc., Boston
Warner & Swasey Co., Cleveland

SCREW PLATES (See **DIES, Screw-Cutting, Adjustable**)

SCREWS, Cap and Set
Allen Mfg. Co., Hartford, Conn.
Baumbach Mfg. Co., E. A., Chicago
Danly Machine Specialties, Inc., Chicago
Detroit Die Set Corp., Detroit
Eastern Machine Screw Corp., New Haven, Conn.
National Acme Co., Cleveland
Parker-Kalon Corp., N. Y. C.
Republic Steel Corp., Cleveland, O.
Standard Pressed Steel Co., Jenkintown, Pa.
Strong Carlisle & Hammond Co., Cleveland

SCREWS, Machine
Allen Mfg. Co., Hartford, Conn.
Eastern Machine Screw Corp., New Haven, Conn.
Lamson & Sessions Co., Cleveland
Republic Steel Co., Cleveland
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Recessed Head
American Screw Co., Providence, R. I.
Central Screw Co., Chicago
Chandler Products Corp., Cleveland
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit
National Screw & Mfg. Co., Cleveland
New England Screw Co., Keene, N. H.
Parker Co., Charles, Meriden, Conn.
Parker-Kalon Corp., N. Y. C.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., Chicago, Ill.
Phillips Screw Mfrs., Providence, R. I.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Shakeproof Lock Washer Co., Chicago
Southington Hardware Mfg. Co., Southington, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
Whitney Screw Corp., Nashua, N. H.

SCREWS, Self-Tapping
Parker-Kalon Corp., N. Y. C.

SCREWS, Thumb & Wing
Parker-Kalon Corp., N. Y. C.

SCRIBERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

SEPARATORS, Centrifugal
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.
National Acme Co., Cleveland

SETS, Rivet
American Swiss File & Tool Co., Elizabeth, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., Cleveland

WHERE-TO-BUY DIRECTORY

SETTERS, Nut (See **TOOLS, Portable**)

SHAFTING, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Earle Gear & Mach. Co., Philadelphia
Jones & Laughlin Steel Corp., Pittsburgh
National Tube Co., Pittsburgh
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Union Drawn Steel Co., Massillon, O.
Wyckoff Drawn Steel Co., Pittsburgh

SHAFTS, Flexible
Dumore Co., Racine, Wis.
Errington Mech. Lab., Stapleton, N. Y.
Haskins Co., R. G., Chicago
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand Co., N. A., Chicago
Walker-Turner Co., Inc., Plainfield, N. J.

SHAPERS
American Tool Works Co., Cincinnati
Ames Co., B. C., Waltham, Mass.
Atkins & Co., E. C., Indianapolis
Atlas Press Co., Kalamazoo, Mich.
Automotive Maintenance Machinery Co., N. Chicago, Ill.
Bryant Machinery & Engrg. Co., Chicago
Cincinnati Shaper Co., Cincinnati
Hanson-Whitney Mach. Co., Hartford, Conn.
Hendey Machine Co., Torrington, Conn.
Machinery Mfg. Co., Los Angeles
Morey Machinery Co., Inc., N. Y. C.
Ohio Machine Tool Co., Kenton, O.
Pratt & Whitney Div., Niles-Bement-Bond Co., Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Rockford Mach. Tool Co., Rockford, Ill.
Smith & Mills Co., Cincinnati

SHARPENERS, Saw
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
Weldon Tool Co., Cleveland

SHAVING MACHINES
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Michigan Tool Co., Detroit

SHEARS, Hand
Black & Decker Mfg. Co., Towson, Md.
Buffalo Forge Co., Buffalo, N. Y.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Minneapolis

SHEARS, Rotary
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Sons, Inc., Jos. T., Chicago
Schatz Mfg. Co., Poughkeepsie, N. Y.

SHEARS, Squaring
Beatty Mach. & Mfg. Co., Hammond, Ind.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati
Cleveland Crane & Engrg. Co., Wickliffe, O.
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Kent-Owens Machine Co., Toledo, O.
Mitts & Merrill, Saginaw, Mich.
Niagara Mach. & Tool Wkks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.

SHEAVES, "V" Belt
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Dayton Rubber Mfg. Co., Dayton, O.
Dodge Mfg. Corp., Mishawaka, Ind.
Earle Gear & Machine Co., Philadelphia
Gates Rubber Co., Denver, Colo.
Hill Acme Co., Cleveland

SHEET-METAL WORKING MACHINERY (See **BRAKES, Bending Press; DIES, Sheet-Metal; Forming Machines; NIBBLERS; PRESSES; REELS, Stripstock; RIVETERS; ROLLS, Bending; SHEARS; STITCHERS, Metal**)

SHELL-MAKING Machinery
Bullard Co., Bridgeport, Conn.
Colman & Sons, Frederick, Detroit
Hepburn American Co., Greenwich, Conn.
Morey Machinery Co., Inc., N. Y. C.

SHIMS, Bearing, Plain & Laminated
Laminated Shim Co., Glenbrook, Conn.

SHIPPING SERVICE
Railway Express, All Principal Cities

SKIDS (See **TRUCKS, Hand**)

SLEEVES & SOCKETS, Drill
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland
Greenfield Tap & Die Corp., Greenfield, Mass.
Hardinge Brothers, Inc., Elmira, N. Y.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

SLOTTERS
Baker Bros., Inc., Toledo, O.
Consolidated Machine Tool Corp., Rochester, N. Y.
Douglas Machinery Co., Inc., N. Y. C.
General Machinery Corp., Hamilton, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

SOCKETS, Drill (See **SLEEVES & SOCKETS, Drill**)

SOLVENTS, Oil & Grease
Detroit Rex Products Co., Detroit
Oakite Products, Inc., N. Y. C.

SPINDLES, Machine
Bryant Chucking Grinder Co., Springfield, Vt.
Dumore Co., Racine, Wis.
Ex-Cell-O Corp., Detroit
Heald Machine Co., Worcester, Mass.
Monarch Machine Tool Co., Sidney, O.
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago

SPRINGS, Die
Allen Mfg. Co., Hartford, Conn.
Danly Machine Specialties, Chicago
Detroit Die Set Corp., Detroit

SPROCKETS (See **GEARS, CUT**)

SQUARES, Precision (See **BLOCKS, Precision Gage**)

STAMPINGS, Metal
Acromark Corp., Elizabeth, N. J.
American Brass Co., Waterbury, Conn.
Continental Machines, Inc., Minneapolis
Dayton Rogers Mfg. Co., Minneapolis
Revere Copper & Brass Inc., N. Y. C.
Standard Pressed Steel Co., Jenkintown, Pa.
Sundstrand Mach. Tool Co., Rockford, Ill.

STAMPS & HOLDERS, Steel, Safety
Acromark Corp., Elizabeth, N. J.
Noble & Westbrook Mfg. Co., East Hartford, Conn.

SMITH & MILLS
CRANK SHAPERS
sizes 12" to 32" stroke
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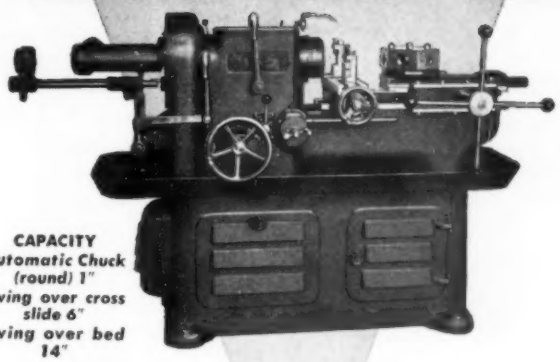

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Swing over bed 14"

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For stamping into metal etc.

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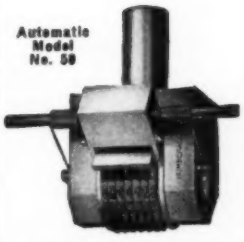

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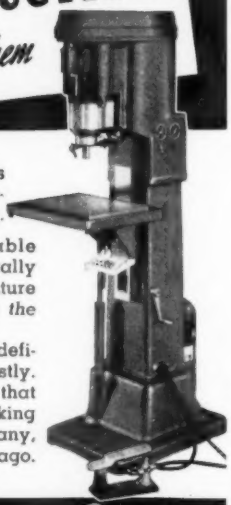

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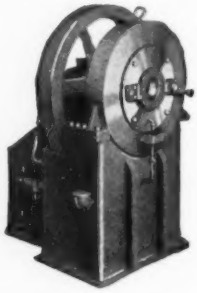

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WHERE-TO-BUY DIRECTORY

STAMPS, Steel (See **DIES, Marking & Embossing**)

STARTERS, Motor (See **CONTROLLERS, Motor**)

STEEL, Die
Allegheny Ludlum Steel Corp., Pittsburgh
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Ryerson & Son, Inc., Jos. T., Chicago
Timken Steel & Tube, Div., Canton, O.
Vanadium Alloys Steel Co., Pittsburgh

STEEL-MILL PRODUCTS
Allegheny-Ludlum Steel Corp., Pittsburgh (Steel and stainless steel sheets, plates, tubes, wire and strip)
American Steel & Wire Co., Cleveland (Cold-finished bars, wire and wire products)
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., Cleveland (Tubing)
Boker & Co., Inc., H., N. Y. C.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Disston & Sons, Inc., Henry, Philadelphia
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc. Div. Borg-Warner Corp., New Castle, Ind.
Jones & Laughlin Steel Corp., Pittsburgh
Latrobe Elec. Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Timken Steel & Tube Div., Canton, O.
Union Drawn Steel Co., Massillon, O. (Cold-finished)
Vanadium Alloys Steel Co., Pittsburgh
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.
Wyckoff Drawn Steel Co., Pittsburgh

STEEL, Stainless (See preceding classification)

STEEL, Tool
Allegheny-Ludlum Steel Corp., Pittsburgh
Armstrong Bros. Tool Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa
Braeburn Alloy Steel Corp., Braeburn, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Climax Molybdenum Co., N. Y. C.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Firth-Sterling Steel Co., Mc Keesport, Pa.
Ingersoll Steel & Disc. Div. Borg-Warner Corp., New Castle, Ind.
Latrobe Elec. Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Timken Steel & Tube Div., Canton, O.
United States Steel Corp., Pittsburgh
Vanadium Alloys Steel Co., Pittsburgh
Wheelock, Lovejoy Co., Inc., Cambridge, Mass.

STERILIZERS, Oil
Barrett Co., Leon J., Worcester, Mass.

STOCKS, Dies & Cutters, Pipe
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland
Pratt & Whitney Co., Div. Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Standard Tool Co., Cleveland
Winter Brothers Co., Wrentham, Mass.

STONES, Sharpening
Bay State Abrasive Products Co., Westboro, Mass.
Behr-Manning Corp., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Midwest Abrasive Co., Detroit

STRAIGHTEDGES (See **DIE-MAKERS' SUPPLIES**)

STRAIGHTENERS, Wire
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Springfield Mach. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

STRAIGHTENING & SIZING MACHINES
Taylor Wilson Mfg. Co., McKees Rocks, Pa.

SUB-PRESSES & DIES (See **Dies, Subpress**)

SUPERFINISHING EQUIPMENT
Ultra-Lap Mach. Co., Detroit

SURFACE-BROACHING MACHINES (See **BROACHING MACHINES**)

SURFACE PLATES (See **PLATES, Surface**)

SWAGING MACHINES
Etna Machine Co., Toledo
Torrington Co., Torrington, Conn.

SWITCHES, Electric
Adam Electric Co., Frank, St. Louis
Allen-Bradley Co., Milwaukee
Allis-Chalmers Mfg. Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Brown Instrument Co., Philadelphia
Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y.
L-W Chuck Co., Toledo, O.
Square D Co., Milwaukee
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

SWITCHES, Limit
Allen-Bradley Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y.
Monitor Controller Co., Baltimore, Md.
National Acme Co., Cleveland
Square D Co., Milwaukee
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

SYSTEMS, Production & Tool Control
McCaskey Register Co., Alliance, O.

TABLES, Elevating Portable
Hamilton Tool Co., Hamilton, O.

TACHOMETERS (See **INDICATORS, Speed**)

TANKS & CYLINDERS, Air
Anker Holth Mfg. Co. (Airgrip Chuck Div.) Port Huron, Mich.
Clearing Machine Corp., Chicago
Curtis Pneu. Machinery Co., St., Louis
National Tube Co., Pittsburgh
Tomkins-Johnson Co., Jackson, Mich.

TAPER PINS (See **PINS, Dowel & Taper**)

TAPES, Measuring
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

TAPPERS, Single & Multi-Spindle
Armstrong-Blum Mfg. Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Baker Bros., Inc., Toledo, O.
Barber-Colman Co., Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bodine Corp., Bridgeport, Conn.
Bradford Mach. Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Buhr Mach. Tool Co., Ann Arbor, Mich.
Bullard Co., Bridgeport, Conn.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati-Gilbert Machine Tool Co., Cincinnati
Delta Mfg. Co., Milwaukee
Ettco Tool Co., Brooklyn, N. Y.
Foote-Burt Co., Cleveland
Geometric Tool Co., New Haven, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hamilton Tool Co., Hamilton, O.
Haskins Co., R. G. Chicago
Hill Acme Co., Cleveland
Kingsbury Mach. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Auto Tool Co., Richmond, Ind.
Rickert-Shafer Co., Erie, Pa.
Snyder Tool & Engrg. Co., Detroit

TAPS, Adjustable (See **DIES, Adjustable**)

TAPS, Hand & Machine, Solid
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Detroit Tap & Tool Co., Detroit
Geometric Tool Co., New Haven, Conn.

WHERE-TO-BUY DIRECTORY

Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Landis Machine Co., Waynesboro, Pa.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Threadwell Tap & Die Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Winter Brothers Co., Wrentham, Mass.
Wood & Spencer Co., Cleveland

TESTING EQUIPMENT, Tension & Compression
Baldwin-Southwark Corp., Philadelphia
Hartford Special Machinery Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.

THREADING MACHINES, Die-Head
Brown & Sharpe Mfg. Co., Providence, R. I.
Dalzen Tool & Mfg. Co., Detroit
Eastern Mach. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., Detroit
Geometric Tool Co., New Haven, Conn.
Grant Mfg. & Machine Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., Cleveland
Lees-Bradner Co., Cleveland
Murchey Machine & Tool Co., Detroit
Oster Mfg. Co., Cleveland
Rickert-Shafer Co., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Waltham Mach. Wks., Waltham, Mass.
Warner & Swasey Co., Cleveland

THREADING MACHINES, Roll
Brown & Sharpe Mfg. Co., Privodence, R. I.
Hill Acme Co., Cleveland
V. & O. Press Co., Hudson, N. Y.

THERMOMETERS, Dial
Brown Instrument Co., Philadelphia
Strong, Carlisle & Hammond Co., Cleveland

TOOL HOLDERS (See HOLDERS, Tool)

TOOL POSTS, Lathe
Armstrong Bros. Tool Co., Chicago
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Williams & Co., J. H., Buffalo, N. Y

TOOLS, Boring
Armstrong Bros. Tool Co., Chicago
Bullard Co., Bridgeport, Conn.
Carboloy Co., Detroit, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Gilmore & Co., F. F., Boston
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Heald Machine Co., Worcester, Mass
Illinois Tool Works, Chicago
Lucas Machine Tool Co., Cleveland
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Sturdimatic Tool Co., Detroit
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Burring
Nobur Mfg. Co., Los Angeles

TOOLS and PARTS, Cemented-Carbide
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford, Ill.
Carboloy Co., Inc., Detroit
Crafts Co., Inc., Arthur A., Boston
Detroit Tap & Tool Co., Detroit
Disston and Sons, Inc., Henry, Tacony Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Grayson Mfg. Co., Monrovia, Cal.
Illinois Tool Works, Chicago
McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Sheffield Corp., Dayton, O.
Tungsten Elec. Corp., Union City, N. J.
Vanadium Alloys Steel Co., Pittsburgh
Vascoloy-Ramet Corp., Chicago
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Diamond-Tipped
Crafts Co., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana, O.
Diamond Tool Co., Chicago
Gilmore & Co., F. F., Boston
Gorton Machine Co., Geo., Racine, Wis.
Kent-Owens Machine Co., Toledo, O.
Norton Company, Worcester, Mass.
Smit & Son, J. K., N. Y. C.

TOOLS, Flexible-Shaft
Dumore Co., Racine, Wis.
Haskins Co., R. G., Chicago
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand & Co., N. A., Chicago
Walker-Turner, Inc., Plainfield, N. J.

TOOLS, Hand
Allen Mfg. Co., Hartford, Conn.
American Swiss File & Tool Co., Elizabeth, N. J.
Armstrong-Blum Mfg. Co., Chicago
Armstrong Bros. Tool Co., Chicago
Atkins & Co., F. C., Indianapolis
Automotive Maintenance Machy. Co., No. Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Capewell Mfg. Co., Hartford, Conn.
Carboloy Co., Detroit
Card Mfg. Co., S. W., Mansfield, Mass.
Cleveland Punch & Shear Works Co., Cleveland
Cleveland Twist Drill Co., Cleveland
Crafts Co., Arthur A., Boston
Dearborn Gage Co., Dearborn, Mich.
Disston & Sons, Inc., Henry, Philadelphia
Elastic Stop Nut Corp., Union, N. J.
Errington Mech. Lab., Stapleton, N. Y.
Gairing Tool Co., Detroit
Greene, Tweed & Co., N. Y. C.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hamilton Tool Co., Hamilton, O.
Lufkin Rule Co., Saginaw, Mich.
National Twist Drill & Tool Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
North Bros. Mfg. Co., Philadelphia
Numberall Stamp & Tool Co., Hugenot Park, N. Y.
Plomb Tool Co., Los Angeles
Pratt & Whitney Div., Niles-Bement-Pond, Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Racine Tool & Mach. Co., Racine, Wis.
Scully-Jones & Co., Chicago
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Thompson & Son Co., Henry G., New Haven, Conn.
Union Twist Drill Co., Athol, Mass.
Victor Saw Works, Inc., Middletown, N. Y.
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Knurling (See KNURLS & KNURL HOLDERS)

TOOLS, Lathe, Shaper and Planer
American Tool Works Co., Cincinnati
Armstrong Bros. Tool Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Auto Ordnance Corp., Bridgeport, Conn.
Blake Co., Edward, Newton Centre, Mass.
Bullard Co., Bridgeport, Conn.
Carboloy Co., Detroit
Cincinnati Lathe & Tool Co., Cincinnati (Lathe only)
Cleveland Twist Drill Co., Cleveland
Colonial Broach Co., Detroit
Empire Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Hendey Machine Co., Torrington, Conn.
Illinois Tool Works, Chicago
Jefferson Mach. Tool Co., Cincinnati
LeBlond Mach. Tool Co., R. K., Cincinnati
Luers, J. Milton, Mt. Clemens, Mich.
McKenna Metals Co., Latrobe, Pa.
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
Nobur Mfg. Co., Los Angeles
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago
Starrett Co., L. S., Athol, Mass.
Sturdimatic Tool Co., Detroit
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Portable Electric
Black & Decker Mfg. Co., Towson, Md.
Chicago Wheel & Mfg Co., Chicago
Delta Mfg. Co., Milwaukee
Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine, Wis.
Hisey-Wolf Machine Machine Co., Cincinnati
Rotor Tool Co., Cleveland
Schauer Machine Co., Cincinnati
Skilsaw, Inc., Chicago
Walker-Turner Co., Plainfield, N. J.

TOOLS, Portable Pneumatic
Cleveland Pneu Tool Co., Cleveland
Onsrud Machine Works, Inc.,
Rotor Tool Co., Cleveland
Sheldon Machine Co., Chicago

TOOLS, Stellite
Haynes, Stellite Co., N. Y. C.

TORCHES, Gas-Cutting & Welding
Air Reduction, N. Y. C.

TRANSMISSIONS, Gear-Shift Type
Drive-All Mfg. Co., Detroit

TRANSMISSIONS, Hydraulic
Barnes Co., W. F. John, Rockford, Ill.
Elmes Engrg. Wks., Chas. F., Chicago
Ex-Cell-O Corp., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit

TRANSMISSIONS, Mech. Variable-Speed
Adams Co., Dubuque, Iowa
Allis-Chalmers Mfg. Co., Milwaukee
Continental Machine, Inc., Minneapolis
Earle Gear & Machine Co., Philadelphia
Morse Chain Co., Ithaca, N. Y.
Reeves Pulley Co., Columbus, Ind.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

TROLLEYS, TRACKS & TRAMWAYS, Overhead
American Steel & Wire Co., Cleveland
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Cleveland Crane & Engineering Co., Wickliffe, O.
Cullen-Friestedt Co., Chicago
Curtis Pneu. Machinery Co., St. Louis
Ford Chain Block Div. Am. Chain & Cable Co., Inc., Philadelphia, Pa.
Harnischfeger Corp., Milwaukee
Mathews Conveyor Co., Ellwood City, Pa.
Standard Conveyor Co., No. St. Paul, Minn.
Wright Mfg. Div. Am. Chain & Cable Co., Inc., York, Pa.

TRUCKS, Hand
Standard Pressed Steel Co., Jenkintown, Pa.

TUBING, Steel
Bissett Steel Co., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Timken Steel & Tube Co., Canton, Ohio

TURRETS, Tool-post & Tailstock
Gisholt Machine Co., Madison, Wis.
Jefferson Machine Tool Co., Cincinnati
McCrosky Tool Corp., Meadville, Pa.
Warner & Swasey Co., Cleveland

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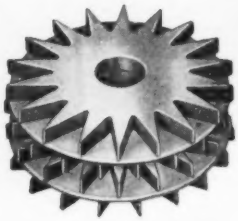

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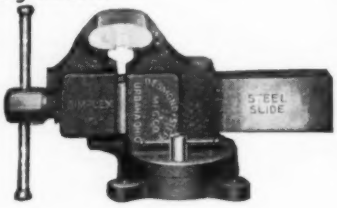

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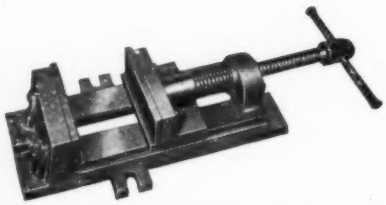

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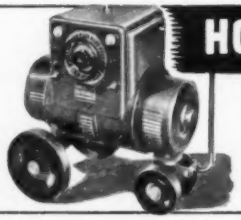

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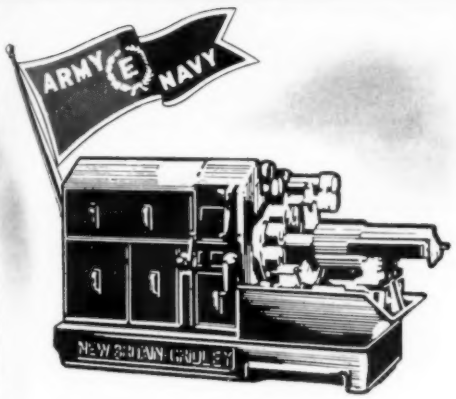

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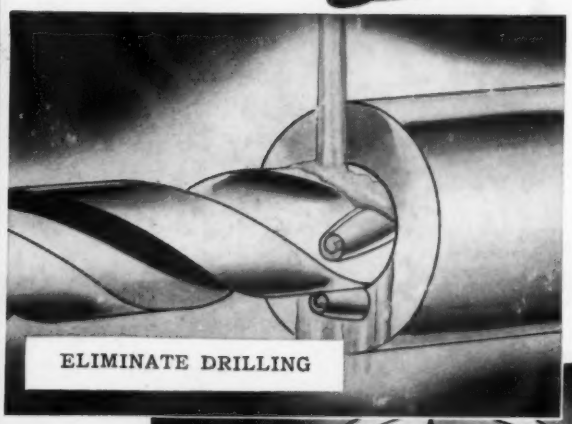
THE BEST WAY TO SAVE SCRAP

Don't make it!



With everybody emphasizing the need for more scrap, some of us have lost sight of the fact that the less scrap we make in our forming operations, the less scrap we will need for making steel.

Select your materials wisely. For instance, perhaps you can reduce scrap and save time by machining your product from tubing (rather than bar stock) and thus:

1. *Eliminate boring* or *drilling.*
2. *Minimize* your *machining time.*
3. *Get more pieces per set-up* on *re-chucking.*

The Timken Roller Bearing Company, Canton, Ohio. Steel and Tube Division.